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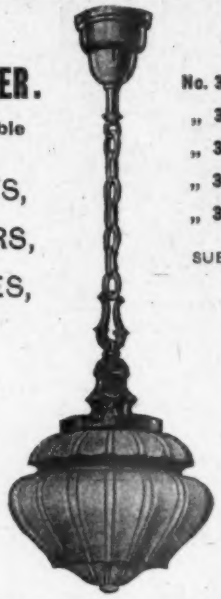

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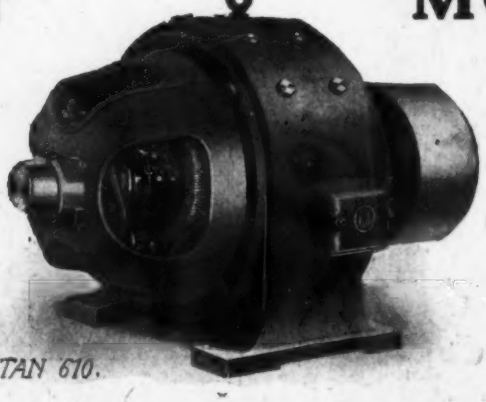

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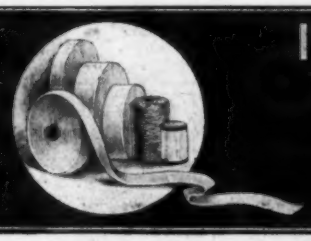

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ELECTRICAL REVIEW.

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THE HACKNEY CASE.

THE case of Dore *v.* Hackney Borough Council, which came before Mr. Forbes Lankester, K.C., some months ago, and has now been adjudicated upon by the Court of Appeal, involves the decision of a question of very considerable importance, not only to electrical undertakers, but to all who are under a statutory duty to supply any commodity to the public. The facts are very simple. The Hackney Borough Council was summoned for making default in supplying electric power to the house of a consumer as required by the Hackney Electric Lighting Order, 1893. The borough electrical engineer was satisfied that the wiring had been properly done, and the committee was anxious to give the supply, but acting on the orders of the Electrical Trades Union, the Council's employés refused to connect because the work was not done by trade union labour, but by a man who was his own master. The learned magistrate found* that the Council was in default, and ordered it to pay a fine and costs. He pointed out that his only duty was to consider whether the failure to connect was due to *force majeure* or not, and said that in the absence of any decision to the effect that mere threats amounted to *force majeure* he held that they did not. "It is to be observed," he said, "that the threat, if acted upon generally (and I was told that this trade union controlled the action of electrical workers throughout the kingdom) would deprive all men in the position of Mr. Cant of an honourable and legitimate livelihood, whilst it avowedly amounts to a claim on the part of the union to dictate to all their fellow subjects the class of persons they shall employ to do private electrical work on private premises. Some may regard such a threat as high-handed and insufferable tyranny on the part of the union. It is not for me to say." The Court of Appeal unanimously confirmed the finding of the magistrate, and dismissed the appeal. It should be noted that the decision of a magistrate is final on a question of fact.

We confess to a feeling of surprise at the attitude adopted by the Hackney Borough Council in this matter. The statute which entitles a consumer to receive a supply is plain as plain can be. The consequences of refusal are made equally clear: "Whenever the undertakers make default in supplying energy to any owner or occupier of premises to whom they may have and are required to supply energy they shall be liable in respect of each default to a penalty not exceeding forty shillings for each day on which the default occurs." The circumstances in which penalties *cannot* be imposed are stated with equal clearness. No penalty can be inflicted in respect of any default if the Court is of opinion that the default was caused by inevitable accident or *force majeure* or was of so slight or unimportant a character as not materially to affect the value of supply. It was not, and could not be, suggested that the failure was due to inevitable accident; the sole question was: Is this *force majeure*?

* His judgment was reported in the ELECTRICAL REVIEW, May 6th, 1921, p. 604.

People unaccustomed to the forms of law may desire to know the meaning and significance of this phrase. Its English equivalent is "the act of God." Suppose, for example, a generating station were knocked down by an earthquake, or the mains were carried away in a flood of almost unprecedented violence, the resulting cessation of supply would be held to be due to the act of God or *force majeure*.

In the course of his judgment Mr. Lankester pointed out that no exhaustive definition of the phrase could be found. But references may usefully be made to another branch of the law. A common carrier is, generally speaking, an insurer of the goods which he carries. But he is not liable for the Act of God or the King's Enemies. His duty was thus defined in an old case: "A common carrier is not liable for any accident as to which he can show that it is due to natural causes directly and exclusively, without human intervention, and that it would not have been prevented by any amount of foresight and pains and care reasonably to be expected from him."

It would indeed be a serious outlook for the public if any Court were to hold that the dictates of a trade-union official were equivalent to *force majeure*. The whole supply of electricity in these islands could then be held up unless the system of supply and the wages paid to the undertakers' workmen were approved by union officials. The supply of gas and water might be equally affected; and the public would have no redress! To a summons for penalties the answer would always be—*force majeure*!

It may be asked: Has the consumer—or would-be consumer—no remedy other than a summons? Can he not bring an action? That it is reasonable to ask this question is manifest when it is explained that a summons, even if successful, brings no pecuniary reward to the prosecutor. The fine is swept into the coffers of the State; the costs awarded (if any) are barely sufficient to cover the prosecutor's out-of-pocket expenses. Why may he not sue for damages?

This remedy does not avail him. It is an old principle of law that where a statute prescribes a remedy for a particular injury, any other remedy which there might be is taken away by implication. So in one case it was held that no action lay against a gas company for damages sustained by a consumer by reason of its failure to give him a supply of gas sufficient in amount and in purity to satisfy the requirements of the Act. His only remedy was to proceed for penalties. In the present case if the gentleman who had reason to complain of the Hackney Borough Council had commenced proceedings in the County Court he would have done so in vain.

It is now many years since the Legislature conferred upon trade unions immunity from actions for wrongs. It was hoped that they would not exceed their privileges; but it must be confessed that the case under review has brought a singular abuse into public notice. It will tend, moreover, to create an uneasy feeling that the exercise of similar powers is a matter of common occurrence, and that it is only by reason of a curious combination of circumstances that the facts of one case were duly brought to light.

The E.T.U. (London District).

Some months ago we remarked, with regard to the electrical wages dispute, that the collapse of the strike was largely due to the flat refusal of many members of the E.T.U. to engage in it; that they were utterly sick of the incessant attempts of their leaders to involve them in strikes, and that there was a "rod in pickle for the Executive of the London Branch." That rod has now attained maturity, as may be gathered from the abstract elsewhere in this issue of a circular recently issued by the National Executive Council of the Electrical Trades Union.

The Council, in fact, exasperated by the insubordination, indiscretion, mismanagement, and recklessness of the London District Committee, has at last suspended the latter. We have often had occasion to criticise the actions of the London committee, and have expressed the conviction that the rank and file of the members in the London district were not in sympathy with, or responsible for, the policy adopted by their hot-headed leaders; our impression is fully confirmed by the terms of the circular, which leaves no loophole for doubt as to the intensity of the indignation with which the Executive Council regards, and for years has regarded, the conduct of the Committee.

Needless to say, we welcome this drastic action; we bear no ill-will either towards the Union, which is capable of doing excellent work in promoting the welfare of the industry, or towards the members of the Committee, against whom we have no personal complaint to make—but we do utterly detest the "policy," if such it can be called, for which the Committee has been responsible—a policy which is almost wholly comprised within the twelve reasons for suspension cited by the Council!

For its attitude towards the Whitley Council system, and its adhesion to the decisions to which it has been a party on the Councils, we commend the Committee. But we regard the *unity* of the trade union as the first essential to its usefulness, and we believe that the action taken by the Executive Council is in the best interests of the Electrical Trades Union, the electrical industry, and the nation as a whole.

Promoting Electricity Supply.

The importance of the work which the Electrical Development Association is peculiarly qualified to carry out has recently been emphasised in various quarters, notably in the presidential address of Mr. J. S. Highfield, the inaugural addresses of chairmen of Territorial Centres of the Institution, and by the Conference of Industrial Councils. Mr. Highfield touched upon it in connection with the necessity of adopting a system of charging for electricity which will enable the price of lighting to be raised to a reasonable figure, and will avoid the necessity of overcharging for power and heating, whilst allowing electricity to be supplied for all purposes through one meter. This can be effected by means of the two-part or multi-part tariff, provided that the obligation to offer an alternative flat rate is removed. As he remarked on a previous occasion, and indicated again in his address, the immediate development of the public supply of electricity is of *vital* importance not merely to the supply authorities themselves, but also to contractors and manufacturers, and to the workpeople whose interests are at stake, affecting as it does the employment of many thousands of men, and immensely improving our position with respect to the development of export trade.

Mr. G. H. Nisbett, in his outspoken address to the Liverpool Sub-Centre of the North-Western Centre, laid great stress on the same point—the dependence of the electrical industry in great part upon the development of new business. Whilst we cannot agree in all respects with his comments upon the relative national importance of power and lighting supplies, we are entirely at one with him regarding the urgent need for developing the domestic side of the business. We regret that we are unable to devote more space to his stimulating address, but plenty of food for thought will be found in the abstract which appears elsewhere in this issue. Before leaving the question of power supply, we may point out that the main objects of the committees which recommended the extension of a "cheap and abundant supply" of electricity to all parts of the country were: to economise fuel, and to enable a greater proportion of mechanical power to be employed in manufacturing operations, thereby increasing output *per capita* and

diminishing the cost of production. Surely these are vitally important "national objects"; the cost of power in percentage of the cost of the finished product may with great advantage be *increased*, if thereby the output of a factory can be doubled and the cost of production reduced.

So far as Mr. Nisbett advocates the extension of electric lighting pure and simple, we fear he will not convince the supply engineer, who knows that the cost of services is from three to four times the pre-war cost, and that in very many cases the profit on the energy used for lighting alone does not even cover the annual charges on the cost of connection. This is particularly true in the case of the small consumer, whose case Mr. Nisbett obviously has in mind, and when he suggests that the supply authority shall bear the cost of the wiring also, he aggravates the difficulty—*unless the authority is empowered to charge a remunerative price*. Thus we come back again to the question of tariffs and the maximum price permitted, which Mr. Highfield dealt with so forcefully. That question has now been before the Electricity Commissioners for about twelve months, and has not lost any of its urgency by the delay. We know the Commissioners are faced with great difficulties in securing a reform of the law on this subject; but no one else is in a position to deal with it, and we look to them to exert every effort to expedite the removal of the statutory restrictions. As things are at present, the only way to secure a return on the cost of wiring is to charge a separate rent for it.

We are pleased to note that the Local Authorities (Financial Provisions) Bill (No. 230, H.M. Stationery Office) has received the Royal Assent, as it contains a clause of great importance to electricity supply undertakings, which have to lay out capital that will not produce a revenue for some years. This clause gives power to suspend payments to the sinking fund for a period not exceeding five years, while the capital expended remains unremunerative. This was one of the concessions that were pressed upon the Cabinet Committee upon Unemployment by the deputation from the Conference of Joint Industrial Councils on November 2nd, and will in great measure facilitate the development of electricity supply.

Replacement of Worn-out Machinery in Germany.

The Berlin Chamber of Commerce recently distributed copies of a pamphlet written by Herr Felix Deutsch, chairman of the directorate of the A.E.G., in respect of the relation borne by wages and salaries to the return on capital invested in industrial undertakings. The pamphlet forms a continuation of one of a similar character which was issued in 1919 in regard to 66 joint stock companies, although in the present case the inquiry has been extended to 152 companies which are also not specifically mentioned, and therefore incapable of being checked. The author endeavours to show that while wages and salaries have increased in the past two years, the share capital as represented by the average rate of dividends paid has considerably declined. It is, however, not to this side of the question that we wish to refer, although the *Frankfort Gazette*, in criticising the pamphlet under the title of "A False Account," states that it has been written for a pronounced purpose, and it rejects the author's conclusions, although we observe that the *Financial Times* swallows them in its issue of November 5th. On the other hand, and in a subsequent issue, the German newspaper directs attention to another part of the pamphlet, and warmly commends the policy set forth therein, to the consideration both of industrial undertakings and of the banks associated with the latter in the emission of new capital. As this particular part is also of interest in this country, which likewise has a depreciated exchange in relation to the United States and two or three other countries, and is also confronted with a considerably greater capital expenditure for replacements of machinery and plant as compared with pre-war times, no apology is needed for reproducing what the chairman of the directorate of the A.E.G. says on the question.

Herr Deutsch first points out that the former method of writing down in gold the machinery and plant to the value of one gold mark—which, as is known, many companies practised in Germany in pre-war times—is no longer sufficient to-day, when machinery and appliances cost from 16 to 18 times the pre-war rates, for the purpose of protecting an undertaking against the consumption of its capital. As a consequence, and in order to render possible the acquisition of new plant (replacements) and maintain the efficiency and competitive capacity of industry, such large renewal reserve funds must be provided that the necessary capital stands available for the purchase of a new machine on an old one being scrapped. As an example, the author says:—

"At the A.E.G. we formerly used certain generally introduced machine tools, one man being required to attend to each machine. One day new machines were offered us from America, every three of which could be served by one workman. That implied a considerable economy, and we therefore did not dare delay making the large expenditure for the provision of the new machines. This progress did not satisfy technicians. Only a short time elapsed before the Americans placed new machines on the market, of which nine could be attended to by one man. For this purpose, of course, a workman of higher intelligence was requisite, while only purely mechanical work had to be performed with the machines originally used. It is now obvious that the considerable expenditure for the new plant could only be borne by an undertaking which, having a large turnover, was able fully to utilise the new machines. This was the case with the works of the A.E.G.; they had for their products a customer with a market comprising the whole of the inhabited globe; the entire organisation of the A.E.G. comprised approximately 400 branches, and they could therefore venture to replace the machines acquired a few years ago with the more efficient but very costly new machines. The result showed that we were right, for we soon increased our sales by more than fivefold, and the large sums were intelligibly and well invested. But—and this is the essential part—we were only able to venture upon this step because we had completely written off the first machines. Otherwise we should not have been able to provide for the redemption also of the new machines, and should have had to leave the business to more intelligent and more far-sighted firms, with whom we should then no longer have been able to compete. This example could be applied to German industry as a whole to-day. Certainly many companies, besides making the customary depreciation, have formed considerable internal reserves by the careful valuation of securities and stocks. But the question whether these are adequate and guarantee that security which is urgently necessary under present conditions arises to-day more threatening and oppressive than ever before."

The warning given in the final sentences of the statement by the chairman of the A.E.G. is certainly not unnecessary. While large sums have been written off by the coal, iron and steel, and engineering companies for depreciation for the past financial year, and considerable sums have been placed to reserve funds, these amounts are totally insufficient to effect replacements of plant and machinery on the present basis of the cost of purchase as contrasted with pre-war sale prices. As a general rule, and in order to make a show of great prosperity, depreciation and renewals reserves are being provided for just as if the companies were working with the mark at par value, whereas the total amount set aside for these two purposes by all the colliery companies in Westphalia in 1919-20—and 1920-21 will probably indicate no difference—would not have sufficed to pay for the sinking of a new shaft to replace one where the coal had been worked out. Similar conditions prevail in the iron and steel and engineering industries, all for the purpose of paying high and, in reality, fictitious dividends. Even where there is a prospect of at once forming a very considerable reserve fund by the issue of new capital for extensions and developments—not for replacements—at a very high premium, and thus permit of the premium being placed to reserves, shares are mostly issued at a low premium in order to please the shareholders in the exercise of their preferential rights of subscription, unless waived, and also to please the directors and their friends. Everything seems to point to a future day of reckoning, when the present sham state of prosperity will be revealed in its true colours.

THE LOW TEMPERATURE CARBONISATION OF COAL.

What is coal?—A substance found in certain geological formations. It is a black solid, and contains pitch, tar, creosote, carbolic acid, tar oils, benzol, ammoniacal liquor. Yes, quite so, and in the same sense a baa lamb contains men and children. For coal contains none of these things, and nobody really can do more than guess what coal is in the sense of being able to formulate the molecular arrangement of the elements into which it may be ultimately resolved. True, when heated in a closed vessel the substances above named and a host of gases in addition are produced, and may be separated and placed in bottles and labelled "Products of distillation of coal." Of late years the tendency has become evident to add to such labelling the words "at 500 deg. C. of temperature," or such other temperature as was given to the retort in which the distillation took place. In all cases of destructive distillation and of combustion, temperature is a crucial factor. The distillation of coal is classed as destructive because, it may be assumed, the coal is changed so greatly in appearance and texture that it ceases to be coal. But constructive distillation would be a better term to employ, for by heating coal its molecules are rearranged, some as gas, others as liquids, and yet others as solids.

The so-called constituents of coal have not been taken from the coal, but entirely novel bodies have been generated. And these new bodies from the same piece of coal will differ according as they are the result of heating the coal gently or bringing it up to a high temperature. Substances brought into being by a temperature of from 550 to 600 deg. C. are represented as low-temperature products. At from 900 to 1,000 deg. C. the distillation temperature is considered as high, and the products of a lower temperature will be "cracked" to use the trade term, with the evolution of fresh molecular structures.

Ordinary illuminating gas is a high-temperature resultant, and the particular aim of this procedure is gas for lighting purposes. High temperature is also employed in producing metallurgical coke, and in this case the gas which is evolved may be, and is, used in driving gas engines or heating boilers. But much of the value of the distillation products is destroyed by high temperature.

Coal for steam production is usually passed directly from the mine to the boiler furnace. The columns of the Electrical Review have for long been open to the pioneers of more rational methods of using coal and of economising the products of distillation. Thwaite, Allen, and Booth worked along these lines nearly 30 years ago. But the motor car and the flying machine, with their greedy petrol-absorbing maw, have done this work of late years, and the need for petrol substitutes has really been the spur which has urged chemists to bring about a more rational employment of coal by using moderate temperatures of distillation in order to secure a more valuable series of molecularly reconstituted substances. The following table of the effects of high and low temperatures is due to Mr. Brownlie. It gives the high- and low-temperature products of 1 ton of coal of an average type:—

—	Low temperature carbonisation.	High-temperature Gas works.	carbonisation, Coke ovens.
In retorts...	14 cwt. of smokeless fuel	13¼ cwt. soft coke	14 to 14¼ cwt. hard coke
Gas ...	6,000 cb. ft. of gas of 700 to 750 B.th.u. per cb. ft.	12,000 cb. ft. of gas of 550 B.th.u. per ft.	11,500 cb. ft. of gas, 450 B.th.u. per cb. ft.
Liquid products	20 gal., including 3 gal. motor spirit & Diesel, lubricating, & fuel oils	10 gallons	8 gallons
Sulphate of ammonia	15 lb.	25 lb.	28 lb.

Much more oil results from the low-temperature process than from high-temperature processes. It contains also less of naphthaline and other more complex products, but more of the simpler products, such as benzol, toluol, creosols, or creosote oil than does the tar of high-temperature retorts. Its value is very much higher, and the final solid residue or coke is very different from gas-retort coke or the product of the coke oven. The coke or coalite from low-temperature distillation has been more or less known for some years, but there have been many difficulties attending its production. It is softer than gas coke, somewhat resembles charcoal, more readily soils the hands, and apparently has its carbon contents in a sort of annealed state, in which condition it is easy to ignite, and it burns with a cheerful glow and with a short flame.

But the object of low-temperature carbonisation is general rather than specific. It is, perhaps, first, de-

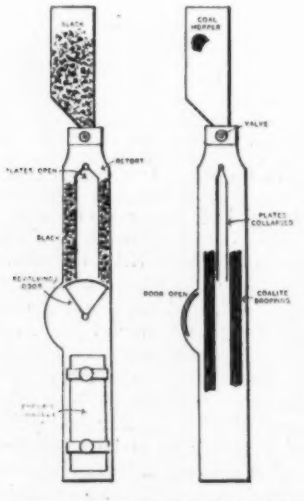


Fig. 1.—Sections of Retort and Cooling Chamber.

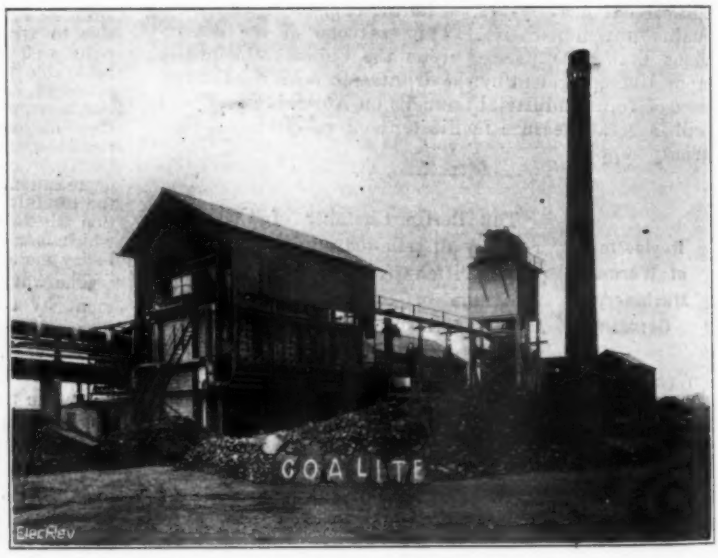


Fig. 2.—Carbonising Plant and Coalite Dump.

sired to produce motor fuel of various orders of density; next, to produce a smokeless house fuel with a capacity for easy ignition, clear burning, and of high radiating power. An ordinary coal fire absorbs much of its heat in distilling filthy gas to pass up the chimney and foul the atmosphere. The blocks of coal burn at their rearward faces and shield off the room from radiant heat. The net result is a pitiable inefficiency. The economies due to a clean atmosphere are enormous; few realise the destructive action of smoke both directly on textiles, and indirectly through frequent and more intensive laundry punishment. And all this waste is

Passing Slack Coal from Hoppers into the Retorts.

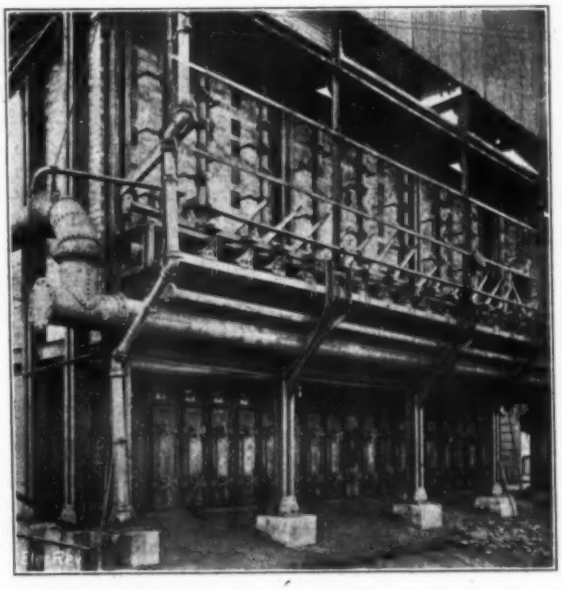
waste of our main national asset, an asset already far depleted and more recently reburied in small areas, too small to be again opened up and worked.

The chemistry of low-temperature distillation is not, perhaps difficult. But there have been technical difficulties of a physical and mechanical order which are now stated to have been overcome by the system of Low-temperature Carbonisation, Ltd., which for several weeks has had plant in continuous operation at Barnsley, Yorkshire, and a special demonstration was held on Wednesday, October 19th, for representatives of the technical Press. The company is using up slack coal and converting it into a smokeless fuel of high value. Experiments and trials have been in progress for 21 years, over 40 different types of retort have been used, and over 200,000 tons of coal more or less satisfactorily treated, and the cost has been very great.

Coal when carbonised at low temperature swells up and becomes viscous, and sticks fast in most retorts. When extracted with great trouble it flames on contact with air, and when quenched it disintegrates badly. The gas passes through the porous retorts, but this difficulty is overcome in the usual manner by maintaining an isostatic condition between the interior of the retort and the exterior. Ordinary gas retorts or coke ovens appear to be useless for producing coalite. If too cool, the result is coke on the surface of the mass and coal inside but little changed. The broken up mixture in no way resembles coalite which, when properly made, is homogeneous, and carries a fixed proportion of volatile matter of such a nature that the gas burns with the short flame with which users of best Welsh are familiar. It appears that a mixture of 70 per cent. non-coking coal with 30 per cent. of coking coal can be employed. This seems to confirm the recent researches of Mr. Lewis, which show that coal which refuses to coke does not do so because of the nature of its constituents so much as because of their laminar structure.

The apparatus used at Barnsley is nearly all of the ordinary commercial type—coal washers, conveyors, gas exhausters, tar separators, and so on. The core of the matter is the retort, and in this most essential feature the company has shown that the old difficulties of low-temperature carbonisation have been overcome in a very ingenious, practical, and simple manner. A unit of ovens is made up of 20 cells. On the top of each cell is a hopper holding 10 cwt. and filled by a conveyor line above. The base of the hopper is closed by a rotary valve or shutter with an external lever to turn it when discharging. The valve passage lets the coal down to the oven or retort, a narrow flat cell 9 ft. deep by 6 ft. 6 in. long by 11 in. to 13 in. wide. In the existing plant the width is 11 in. The small mixed coal remains in this cell for seven to eight hours subject to heating from gas flames outside the cell walls, which are of firebrick. The rotary shutter forming the base of the cell serves to allow the carbonised mass to fall into the cooler below. This cooler is a narrow water-jacketed cell in which the finished product remains several hours to cool. As it is sealed up, no air can enter and there is no flashing into flame. Just before a charge is to be dropped from the retort the cooling cell door is opened. The contents are raked out upon a slope, down which the coalite—now not hotter than 100 deg. F.—slides to the base of the slope, whence in a complete plant a conveyor will carry it away to the storage dump or direct to rail wagons.

Coal subject to low-temperature carbonisation intumesces, and as Weller would say, "swells wisibly," and has always given trouble in the past by sticking fast in the retort. Just here comes in the vital point of the new oven (fig. 1). The cell is fitted over its length and height with a pair of ½-in. perforated steel plates, hanging about 4 in. apart. At the top they are fitted with inclined suspension links, and at the base they are kept apart by lugs. The cell is thus made up of two coking chambers separated by an internal empty space. Into this space, which is drawn upon by the exhausters, passes the gas from every part of the charge through the perforations, and the exhausters maintain atmospheric pressure throughout the cell, and this prevents any diffusion of gas through the porosity of the cell walls. Were this not done the generated gas would pass through the walls and burn outside; it would be impossible



Fire-brick Retorts, with Cooling Chambers Below.

to control the oven temperatures, and there would be great loss of valuable gas.

By a simple movement of the suspension gear the plates fall inwards towards each other, and their lower lugs slide past each other so that the central space of the retort is reduced by one-half and the converted charges are set free, and will drop out by gravity on opening the lower rotary shutter.

The various operations were shown in action, and the charges examined. The coked mass has a peculiar mottled surface, and shows evidence of its structure from small coal. It is firm and dense, and obviously fit for carriage. It burns with a steady glow, has great heat radiating effect, and is clean to the extent of containing only 5 or 6 per cent. of ash. It is unmistakably a successful and excellent fuel made from coal that is of little value in its small condition—being, of course, the inevitable waste product of mining operations.

The gas drawn from the cells is cooled in the usual way, and the liquids are sent away for conversion to benzol, toluol, and other compounds. Carbonisation is carried on at about 600 deg. C., and the yield of coalite is about 1,612 lb. per ton of coal. The cells are heated by the admission of gas through a number of pipes which pass through the front and back walls of the oven spaces between the cells. Where the finally produced gas can be sold to gas companies for mixture this should be done, producer gas being used for the retort heating. At the demonstration plant the gas, purged of its valuable by-products, is employed for this purpose. The efficiency is good. Coal containing 30 million B.th.u. will yield coalite containing 22 million and oil containing 3 million B.th.u. Apparently 5 million heat units disappear by radiation or in the oven exhaust, or are locked up in latent form in the liquid and gaseous by-products, or in generating steam.

As a fuel, coalite has about the same calorific value as the coal it is made from, but it is superior in its heat radiation effects, and has the advantage of small ash contents. It is free from smoke—a property really worth many millions sterling to the householder. Yet it has sufficient clean burning volatile matter to make a cheerful fire—supposed to be necessary for every home-respecting Englishman.

The tar has a sp. gr. of 1.06, and contains much of the valuable creosols and less phenols than high-temperature tar and no naphthaline—the bane of the gas-works. Distilled at up to 300 deg. C. the tar oils may be used in engines, and will produce 2 b.h.p.-hour per pound of oil. Lighter fractions may be taken off at 170 deg. and upwards. The gas of 750 B.th.u. per cu. ft. has 27.5 per cent. of hydrogen, 48 per cent. of methane, 10.1 per cent. of other hydrocarbons, 7.3 per cent. of CO, and 3 per cent. of unsaturated hydrocarbons, and only 2.5 of CO_2 and 1.6 of nitrogen. It is thus over 95 per cent. combustible.

The salient points of the new apparatus are the collapsing plates in the cells and the cold chamber to hold the hot discharged coalite until cooled beyond any risk of flashing, but the whole combination is extremely neat and effective, and we are of opinion that the mechanical difficulties of making coalite have been well solved.

Since writing the foregoing article, we have received from Messrs. Close Brothers & Co., Ltd., who control the process, a copy of a report by Sir Percy Girouard, K.C.M.G., based on his independent observations and investigations. Sir Percy speaks very highly of the process, which he regards as "a great step in advance in low-temperature carbonisation," and he lays stress on the national importance of the process in the industrial field.

Our attention has recently been called to two systems of low-temperature carbonisation besides that of coalite.

In the Lamplough system the product, which we understand should not be called coalite, is not brought out of the retorts in the form in which it is supplied to consumers, but is subsequently briquetted. The Lamplough Co. are not, we believe, to be manufacturers of fuel so much as suppliers of the plant to collieries and manufacturers on a royalty basis. We have no technical scription of the process, so we cannot say how the extra process of briquetting is justified by economies in the earlier processes of washing and heating.

In the Freeman system the process is continuous and somewhat progressive in its heating of the coal which is discharged for further treatment by briquetting, or a further coking process, or pulverising.

There is evidently considerable thought being given to the question of coal treatment generally, and it is certain that coal ought not to be burned as such with destruction of its valuable by-products and the production of filthy, tarry, and oleaginous smoke.

THE BANDY MOTOR.

By "ANODE."

The writer recently had an opportunity of visiting the works of Messrs. Berkeley & Young, Ltd., the makers of the well-known "Emcol" motor, and was extremely interested in a further development in connection with the "Emcol" system of enclosure, this now being fitted to the single-phase repulsion induction motor of their manufacture, better known as the "Bandy."

The Bandy motor is largely used for lift work, and in connection with cranes, hoists, &c., also for printing presses, and similar work where speed variation and control are essentially required.

This type of motor has many advantages over the ordinary induction motor, the principal one being that the starting current is limited to one-and-a-half times the running current, but the special feature of the Bandy motor consists in the fact that the speed can be varied over a wide range, at the same time ensuring that this shall remain constant, or practically so, at the figure to which it is set at any point between full and no load, and the following results obtained in actual use show the extremely small variation under a wide range of speed:—

	R.P.M.		R.P.M.		R.P.M.
Full Load	1,380	...	960	...	800
Half ,,	1,390	...	980	...	820
No ,,	1,400	...	1,000	...	840

Two of the earliest difficulties met with in fitting a governor to a motor were in overcoming the brush friction, and also considerable speed variation would occur before the governor operated.

In the Bandy motor the former difficulty is overcome by floating the brush rocker on ball bearings on the shaft, the rocker being held in place by a chain attached to the governor arm; this method of mounting the rocker is clearly shown in fig. 2, from which the mode of

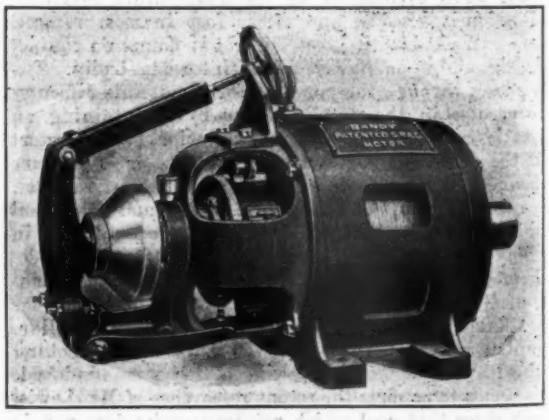


Fig. 1.—The Bandy Motor with Governor.

operation of the governor can also be easily gathered.

By altering the tension of the spring by means of the hand wheel shown in the illustration of the complete machine, the effect of the inward or outward movement

of the governor balls is modified accordingly, and the ultimate speed of the motor is thereby controlled. This can, of course, be done while the motor is in operation if desired.

This method of control enables a small governor to control the speed of the motor within very narrow limits, practically the only friction which has to be overcome being that of the governor itself.

A most interesting installation of these motors is to be found at the sewage pumping station of the Bedford Corporation, where there are four of the 70-h.p. vertical type Bandy motors, the stator voltage being 2,000; the control is entirely automatic and electrically operated by float gear.

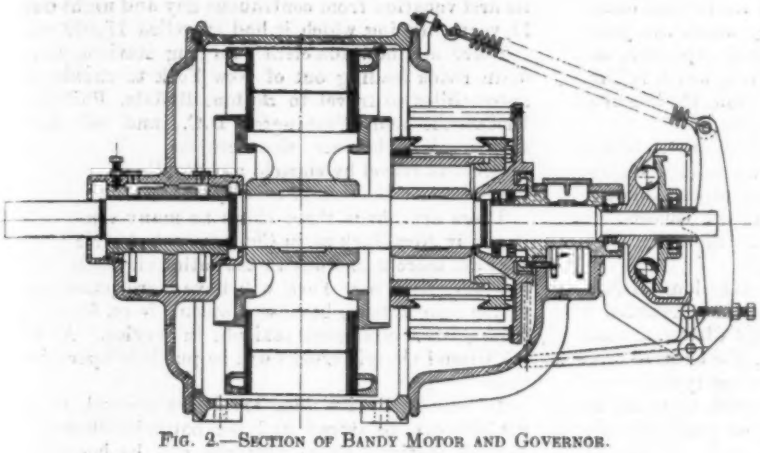


Fig. 2.—Section of Bandy Motor and Governor.

As these motors work under unfavourable conditions as regards moisture, it is essential that the windings be kept dry, and this is ensured by the stator current being kept on continuously; as the speed of these motors can be varied from zero upwards, it is only necessary for the brushes to be brought to the zero position to stop the motor. No damage can therefore be done to the windings, and the fact that these motors have been in use for several years proves this statement.

These motors are used largely in districts where the supply authorities restrict the starting current within limits. Portsmouth is an example, where it is stipulated that this shall not be more than 1.3 times the running current, and an instance of this is to be found in a Temperley travelling bridge transporter, where the installation consists of two sets of motors, each comprising:—

1 65 h.p. 600 r.p.m. for hoisting full grab at 240 ft. per min.
1 30 h.p. 600 r.p.m. for transporting at 800 ft. per min.
1 15 h.p. 600 r.p.m. long traverse at 40/50 ft. per min.
1 10 h.p. 700 r.p.m. for beam lifting.

These motors run on a 200-volt, 50-period supply, and are operated by drum type controllers, as in a d.c. installation, and easily comply with the stringent restrictions laid down as to starting current.

In addition, these motors are also made in the short-circuited type, and, as already stated, with the Emcol system of enclosure; the illustration, fig. 3, shows a 5-h.p., 1,430 r.p.m. motor for a 220-volt, 50-period, single-phase supply, and this machine, after a six hours' full load run, had a temperature rise of only 45 deg. F., a highly satisfactory result.

In conclusion, I have to tender my thanks to Mr. H. C. E. Jacoby, the patentee, for kindly giving me some of the facts and figures mentioned.

C.A.V. Dynamos.—Messrs. C. A. Vandervell & Co., Ltd., of Acton, have supplied no fewer than 2,000 dynamos since January 1st, to the London General Omnibus Co. This statement will indicate the part played by C.A.V. in the lighting of the new type of 'buses running on the London streets. In addition they have supplied 1,500 dynamos to the various oil companies alone in the Metropolis this year.

ELECTRIC TRUCKS IN NEW YORK CITY.

By E. KILBURN SCOTT.

The use of electricity for driving trucks, delivery wagons, and vehicles is growing rapidly in the larger American cities, and this is especially the case in New York and Chicago, through the active campaign of the New York Edison Co. and the Commonwealth Edison Co., of Chicago.

Electric vehicles have been used in New York City for 20 years, and there are on the road 70 of that age. On January 18th, 1920, there were in use in the Metropolitan district 3,851 trucks, of which 2,448 had been in use six years. Six firms have each over 100 trucks, three firms have between 50 and 74 trucks, ten firms between 25 and 49 trucks, whilst there are 30 firms which have each 10 to 24 trucks in regular use.

The total investment in electric trucks now running in the Metropolitan district (not including Brooklyn) is 23 million dollars, and the sale of electric trucks during 1920 amounted to about three million dollars, which is 450 per cent. greater than the sales of 1919.

The automobile bureau of the New York Edison Co. has made a careful estimate of the saving to the public by use of electricity instead of petrol for vehicles, and finds it is annually about 6¾ millions ,or at the rate of $8 per car per day. There are at present 42,000 petrol trucks in New York City, and at least half of these can be converted into electrics. Assuming 21,000, then a saving of only $4 per car per day for 300 working days gives a total annual saving of $25,200,000.

There are 54 charging and boosting stations in Manhattan and the Bronx, and 19 in Brooklyn, which is almost three times the number in use in Chicago. The Electric Storage Co. spent over half a million dollars in 1920 in building electric garages and charging stations.

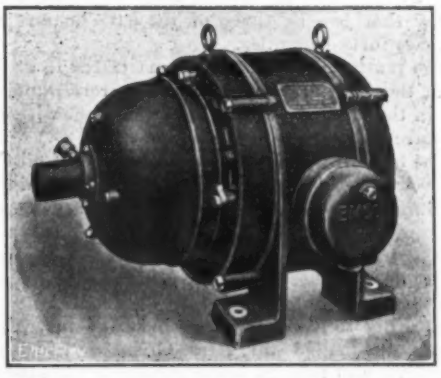


Fig. 3.—Bandy Induction Motor with Emcol Enclosure.

The average daily route for a horse is under 25 miles, whereas an electric vehicle can do up to 45 miles, and with a short boost can increase this by one-half. Horses consume food every day, whether they are working or not, whereas electric vehicles only consume energy when in use, and one electric can do the work of two to four horses, depending on the nature of the work. The speed of an electric is about double that of a horse-drawn truck. Ten years is a conservative estimate of the length of service of an electric truck, whereas horses average only about four years for heavy trucking.

Weather conditions have a serious effect on horse

transportation. In 1921, in one week, 776 horses died from heat, and, in winter, horses are constantly being injured by slipping and falling on icy pavements.

An electric battery never freezes, and although at temperatures of 20 deg. F. below freezing point chemical action is a little sluggish at first starting up, this disappears directly current warms up the electrolyte.

With gasoline engines there is trouble, when the temperature gets below zero, because the water in the radiator may freeze unless care is taken to add sufficient alcohol or to drain off the water whilst the vehicle is standing. Should the water in the jacket of the engine freeze, there is great liability of the casting being cracked by the expanding pressure of ice formed inside.

The life of a gasoline truck is only about five years, because the engine is reciprocating and explosive, and therefore causes a great deal of vibration, which is liable to crystallise the steel. On the other hand, the life of an electric truck may be from 10 to 20 years.

Electric trucks were first used by the old American Express Co. in 1907; as a war measure several Express companies consolidated under the name of the American Railway Express Co., and the combined concern has now 1,200 electric trucks operating in the country, of which 360 are in the New York area.

The company uses gasoline cars for long-distance haulage, and wherever the greater cost is warranted by the increased mileage, but in congested districts, where many stops and starts are necessary, the electric truck has shown itself to be superior to all other types.

At loading platforms an electric truck occupies less space than either horses and wagons or gasoline motor cars of similar carrying capacity, and it can be manœuvred in less space.

For trucks of the two, three, and three-and-a-half ton sizes, the average cost is about seventeen cents per mile, exclusive of driver's wage and insurance.

Electric service is capable of carrying 60 to 80 per cent. overload without undue strain or damage, as shown by the fact that out of a total of 212 electric trucks at the main garage, 206 are on the streets every day.

The Bush Terminal Co., of Brooklyn, has 33 trucks, 25 being five-ton vehicles, which were installed during 1916 and 1917. They lose on the average less than twelve days' service during a working year. As a fleet, they average 887 miles each day, while there is hardly a day that two or three of the cars do not run from forty to forty-five miles.

The trucks handle a great part of the local deliveries from the terminal, serve manufacturers whose factories are in the big loft buildings, and connect with customers who are scattered throughout the city.

The big loft buildings of the Bush Terminal Co., along the South Brooklyn water front, are occupied largely by manufacturers whose raw materials are imported or come in by freight train and lighter. Railroad connections carry finished product to points away from New York, but the electric trucks handle all deliveries within the city itself.

In order to make an early morning start, the electric trucks are loaded up after finishing their afternoon journeys, and then go to the garage to have the batteries charged during the night. They get away at seven in the morning, and this early start makes possible a second trip in the afternoon.

In addition to the trucks for general deliveries, the Bush Terminal Co. has a fleet of storage-battery tractors and trailers. Each trailer carries loads of merchandise from the pier to the warehouse, where it is left while the tractor goes off for another. These tractors are very powerful, and it is a regular thing to use them to shunt loaded railway cars if no locomotive is available. Some tractors, equipped with cranes, have been in use about nine years. When the trucks come to the garage at night they are lined up, facing the middle of the floor. Charging plugs hang from the ceiling in a line down the centre of the building, and as the vehicles are face to face it is possible to charge several batteries in turn from the same plug.

The first Electric Automobile Show in New York was held in February last in the palatial showrooms of the New York Edison Co. at Irving Place. Street trucks and pleasure care were shown during the first week; industrial trucks, tractors, and trailers the second week; and batteries and accessories for the entire period.

The Walker Vehicle Co. showed a 3½-ton chassis 22 ft. long, which was manœuvred by the chauffeur into position between two showcases with a clearance of only about a foot, thus showing the ease of control.

A particularly interesting exhibit was the first industrial truck used by the New York Central Railroad, and the week spent at the Irving Place showroom was its first vacation from continuous day and night duty for 11 years, during which it had travelled 17,000 miles.

There are now sufficient charging stations along the main roads leading out of New York to enable electric automobiles to travel to Boston, Buffalo, Philadelphia, Richmond, and Washington D.C., and call at many smaller cities between these centres It will soon be possible to travel by electric automobile from New York to Chicago, a distance of over 1,000 miles.

There are about three times as many electric trucks in use in New York as in Chicago, but electric passenger cars are more numerous in the latter city. It is likely, however, that New York will have more passenger cars in the near future, because a scheme is on foot to place a large fleet of electric taxicabs in service. About 150 additional electric trucks will be put into operation this year.

In New York City there are 15 garages where electric vehicles can be stored and the batteries charged, &c., also 75 stations where batteries can be boosted. The usual charges are:—

Carrying capacity of car in lb.	Cost per month for storage, inspecting, charging, garaging, washing & flushing batteries.
750 lb.	$48 to 55
1,000 lb.	$53 to 70
2,000 lb.	$58 to 80
4,000 lb.	$63 to 90
7,000 lb.	$70 to 105
10,000 lb.	$75 to 115

HAIGH'S ALTERNATING-STRESS TESTING MACHINE.

A METALLIC structure is permanently safe when, and only when, the stresses remain within the fatigue limit. It is the object of fatigue testing machines to determine this limit, but if operated at a low frequency of reversal, the time required for a single test becomes considerable and, moreover, if irregular vibration is produced, it is impossible to measure the range of load with accuracy.

In the course of research work at the Royal Naval College at Greenwich, Prof. Haigh overcame these drawbacks, and produced a machine that is capable of making rapid tests with high frequencies of reversal, and by means of a simple device the range of stress may be varied at will and measured with accuracy. Messrs. Bruntons, of Musselburgh, Scotland, manufacture the new machines, which have been supplied to the National Physical Laboratory at Teddington; the R.A.E., Farnborough; the Universities of Edinburgh, Birmingham, Sheffield, and others. An important advantage of this type of machine lies in the uniform distribution of the alternating stress across the full section and along a considerable length of the test piece. When testing by means of bending stresses, it has not been possible to determine the fatigue limit with accuracy because the test piece cracked at a fillet when the intensity of the stress was indefinite. The new machine obviates that difficulty, and may be applied in wider fields of research to test models of machine parts as well as simple test pieces.

The machine occupies comparatively little floor space, stands about 5 ft. in height, will admit test pieces up to a length of 15 in., and its frame is arranged to allow for special tests, *e.g.*, to allow of an electric furnace being placed around the test piece for tests at high temperatures. The range of stress, which is indicated on the special stress-meter shown mounted on the wall behind the machine (fig. 1), can be varied up to a maximum of 1.5 tons. The action of the machine depends on the pair of electromagnets M_1 and M_2 (fig. 2), which are energised by two-phase current. The forces generated by these magnets, pulling on the opposite sides of the single armature A, are transmitted to the lower end of the test piece T, the lower end of which is gripped by the adjustable head-

piece H. No considerable vibration is transmitted to the foundation, and the device is almost silent in operation. The frequency of reversal of the stress is governed by the speed of the alternator that energises the magnets, and is usually 2,000 stress cycles per minute, corresponding to a speed of 1,000 r.p.m.; each cycle of stress includes one pull and one push. Although the majority of tests are performed with stresses ranging between equal intensities of pull and push, the ratio between the extremes may be varied at will, which adjustment is effected by giving the flat springs S a suitable degree of initial load as indicated on the scale I. The springs serve

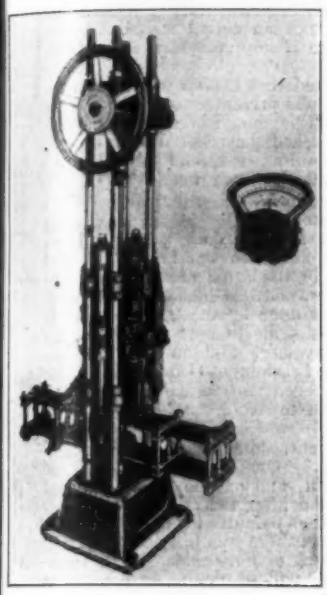


Fig. 1.—Haigh's Stress Testing Machine and Stressmeter.

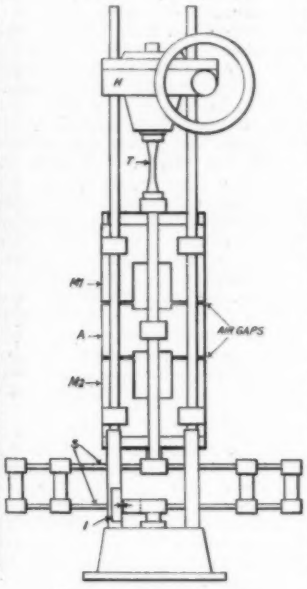


Fig. 2.—Elevation of the Machine.

the further purpose of compensating the force required to accelerate the armature and its fittings in their small but very rapid vertical movement; by means of the clamps the spring stiffness may be adjusted to suit widely different frequencies of operation.

The standard equipment, in addition to the testing machine itself, includes the following items: a switchboard on which are mounted the combined stress meter and differential ammeter; a main switch with an automatic cut-out to operate on completion of the test; and two regulators (coarse and fine) for adjusting the range of stress; a two-phase alternator for 2,000 stress cycles per minute, fitted with a counter for re-

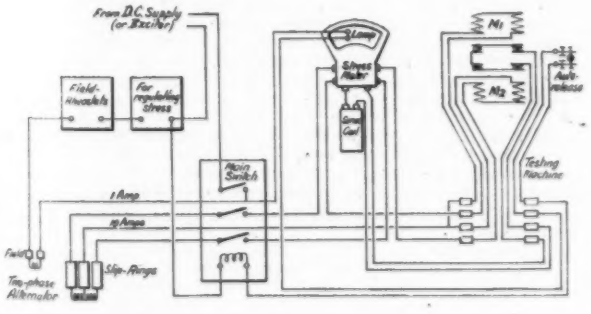


Fig. 3.—Standard Wiring Diagram.

cording the number of cycles required to break the test piece, and driven by a 1 h.p. motor; when a d.c. supply is available, the machine needs no exciter. Fig. 3 is a wiring diagram for a standard set.

The regulators vary the range of stress on the test piece by controlling the alternator voltage that is supplied to the testing machine. The readings of the stress meter do not directly indicate the stress, but must be interpreted by the aid of a calibration chart that is supplied with each outfit. This electrical instrument combines two movements with separate pointers in a single case—viz., the differential ammeter which is used to balance the currents in the two phases, and the stress indicator which resembles a voltmeter in its action, but does not read the voltage. If required, apparatus consisting of a mirror camera is supplied for the purpose of checking the calibration of the outfit.

LEGAL.

British Thomson-Houston Co., Ltd., v. Corona Lamp Works, Ltd.

As briefly mentioned last week, the hearing commenced in the House of Lords on 7th inst., of the appeal by the British Thomson-Houston Co., Ltd.

The appellants alleged that the respondents had infringed their letters patent No. 101,918 of 1913, granted for an invention entitled "Improvments in Incandescent Electric Lamps." The respondents replied in their defence (*inter alia*), want of subject matter, insufficiency and non-infringement. Mr. Justice Sargant held that the respondents had infringed, and that the specification of the appellants' letters patent disclosed an invention of a high order of merit and of great utility, but he held the letters patent to be invalid on the ground that claim 1 did not sufficiently define the ambit of the monopoly claimed, inasmuch, as the word "large" used in the claim did not sufficiently define the dimensions of a filament coming within the combination claimed, and the lamp maker could not ascertain without experiment and trial, whether or not he was infringing the appellants' patent. He therefore dismissed the action. In the Court of Appeal the Master of the Rolls and Lords Justices Warrington and Younger expressed agreement with the judgment of Mr. Justice Sargant, and in particular that the word "large" as used, in claim 1, was too vague to limit the ambit of the claim.

The appellants now contended that the judgments below were erroneous in so far as they held that claim 1 of their specification was too vague and indefinite.

Sir Arthur Colefax, K.C., Mr. Hunter Gray, and Mr. James Whitehead appeared in support of the appeal (instructed by Messrs. Bristow, Cooke and Carpmael), while Sir Duncan Kerly, K.C., Mr. Robert Frost, and Mr. J. E. Walker (instructed by Messrs. H. C. Morris, Woolsey, Morris & Kennedy) were for the respondents.

Sir Arthur Colefax, opening, said that the question now before their Lordships had considerably narrowed down since the action was launched, and the judgments below were challenged as erroneous only so far as they held the appellants' patent to be invalid. The appellants' invention consisted in the use of a filament of tungsten or other refractory metal. This filament was placed not in a vacuum as was the universal custom at the date of the letters patent, but in an inert gas or vapour of low heat conductivity, and was caused to incandesce at a very high temperature by passing through it an electric current. An incandescent electric lamp of this type was an entirely novel article of manufacture and opened up a new field in electric incandescent lamp lighting, with the result that the arc lamp had been largely displaced and the vacuum lamp was being gradually superseded. The appellants' invention was a lamp that fulfilled their requirements, and was the result of many years' experiment and research. Expert evidence given at the trial proved that a lamp could be made from the specification without requiring experiments to be made by the workman. There was no ambiguity in the word "large" as alleged in the particulars of objection, nor was the state of common knowledge such at the date of the patent as to render the invention one an unfit subject for a patent.

The hearing of the case was continued into this week. On Tuesday Sir Duncan Kerly was speaking for the respondents, and the case was expected to last the rest of the week. We shall continue our report next week.

Armature Repair Claim.

At the Peterborough County Court, last week, the Armature Repair Co., Ltd., was sued by Geo. Andrews & Co., electricians, for the sum of £12 6s. 6d. The prosecution alleged that the defendants were given a dynamo to repair. Upon its return it was not used for five or six months, and when it was required it was impossible to excite it. The defendants sent a man to inspect it, and he reported that the field coils required rewinding. This was done, but still there was no excitation. A second man attempted to remedy this, but without success, and finally the plaintiffs repaired the machine themselves. The defendants stated that after the repairs were carried out the armature was given a voltage test with satisfactory results. They were only asked to repair the armature.

After further evidence the judge said that there had been no negligence, but he thought that reasonable care had not been exercised. He awarded the plaintiffs £3 8s.

Platelayer's Claim.

In the Mayor's and City of London Court, on Monday, before his Honour Judge Atherley-Jones, K.C., Richard Goldsmith, platelayer, claimed against the Consolidated Construction Co., Ltd., electrical and mechanical engineers, compensation for personal injuries which were caused to him on August 25th while working for them. Mr. Martin O'Connor appeared for the plaintiff, and Mr. Edgar Dale for the defendants. Mr. O'Connor said that the plaintiff was helping to carry a tram-rail weighing 15 cwt., when it slipped and fell, hurting his

foot and ankle. He attended hospital as an in-patient for some weeks, and in June the defendants offered him work as a watchman or flag man, which involved standing for 12 hours a day. He found that was absolutely impossible, and he declined it, particularly considering that he would have had to work seven days a week. Defendants had discontinued the payments of 35s. a week, and now the plaintiff demanded a continuance of the compensation, as he said he could not work. Goldsmith denied that he preferred 35s. a week to doing light work. Defendants called medical evidence to show that the plaintiff could do light work if he liked. He would not have had to stand 12 hours a day. No man could possibly do that. He would be better working at a light job than doing nothing. Defendants offered to make up his wages to the former amount before the accident if he could not earn as much doing light work. Judge Atherley-Jones, K.C., found for the plaintiff for £1 a week until further order, with costs.

Smoke Nuisance Prosecution Withdrawn.

Hearing was resumed on November 10th, at Bradford City Police Court, in a case in which the Health Committee prosecuted Edward Lynch, a stoker in the employ of Thwaites Bros., Ltd., electrical and general engineers, for smoke nuisance as a result of using certain furnaces. The case was adjourned three weeks previously. The defence was that the firm were exempt from the smoke abatement clauses of the Bradford Corporation Act, 1910, being a foundry. They contended that the process of annealing, which was that under review, was part of the whole process of steel manufacture in which they were engaged. The prosecution had contended that annealing was a finishing process, and that a place where finishing was carried on was a factory, within the meaning of the Act. Last week, however, Mr. W. H. Pollitt, for the Health Department, said the prosecution had taken expert advice as to whether annealing was finishing or not, and as a result of the advice he asked for withdrawal of the case. Mr. W. Bird, defending, gave an undertaking that the firm would take every possible care to minimise smoke emission. The Stipendiary Magistrate, in allowing withdrawal, said if the case had gone on he would have wanted to hear a good deal of expert evidence.

Dore *v.* Hackney Borough Council.

Mr. Justice Darling, Mr. Justice Sankey, and Mr. Justice Branson, sitting as a Divisional Court of Kings Bench on November 14th, heard an appeal by the Mayor and Corporation of Hackney against a conviction by a magistrate under Sec. 26 of the Hackney Electric Lighting Order, 1893, for failure to supply electricity to the respondent, Mr. Dore.

Mr. Schofield appeared for the appellants, and Mr. S. C. Hardy for the respondent.

Mr. Schofield said that the appellants were convicted by the magistrate upon an information that they had made default in their obligation in regard to the supply of electric power or energy, and the question for the Court was whether the default of the appellants in giving supply of electric energy was caused by the action of a trade union, and if so, whether was such default was due to *force majeure*. The Act provided that the electrical undertaking at the request of the owner or occupier of premises should give and continue to give a supply of energy to such premises, and clause 26 said that whenever the undertakers made default in supplying such energy they should be liable to a penalty not exceeding 40s. a day during the continuance of such default. There was, however, a proviso that no penalty should be inflicted if the Court were of opinion that the default was unavoidable or the result of a *force majeure*, or of a slight character. All the employés of the appellants were members of the Electrical Trades Union, and on the 29th March last the appellant's engineer received notice that respondent's premises had been fitted by non-union men, and that the employés would not proceed with the work of connecting. Several interviews took place between the parties, and the appellants used every endeavour to induce their employés to obey orders and carry out the work. If, under the circumstances, they had used other labour, a large body of men would have been withdrawn from the Hackney works. The respondent contended that he was entitled to the energy under the Act, but, on the other hand, the appellants contended that the failure to supply was not consequent upon any default of theirs, and they were entitled to the protecting proviso of *force majeure*. The magistrate was of opinion that the proviso only applied to physical force, and that the appellants were liable under the order.

Counsel proceeded to cite a number of decisions, amongst them those of Justice Walton, Justice Bailhache, and Justice McCardie, the effect of which was that *force majeure* meant something that was beyond the control of the contracting party having regard to the general terms of the contract—something that was unavoidable. Supposing, said counsel, the liability was under contract, and not under an Act of Parliament, the authorities showed that something which was unavoidable excused the parties under the obligation. There was a case of the Industrial Dwellings Co. against the East London Water Co., where a supply of water had been refused. The Court there held that as the neglect was caused by drought it was an unavoidable cause, as the water company had done its best to afford the supply. In that case the Court of Appeal upheld the decision of the magistrate.

Mr. Justice Sankey: Is there any difference between being prevented by a strike and being prevented because there is going to be a strike, or might be a strike?

Mr. Schofield said his submission was that there was not. The Corporation had done its best under exceptional circumstances, and it could not have avoided this. It made no difference because there was not an actual strike, because there could have been a strike if any compulsion had been used.

Mr. Justice Darling suggested that a man who undertook to do a thing because a pistol was presented at his head, and told that if he did not he would be shot, would have unavoidable cause, but supposing, he asked, he was only threatened, would that be an unavoidable thing, or should he wait until he saw whether the man would shoot or not?

Mr. Schofield submitted that in this case, if there had been a strike, it would have resulted in the stoppage of the electric light and consequent inconvenience throughout an enormous district. Where an obligation was imposed by Act of Parliament they were not in the same position as if the obligation were imposed by contract. It had been suggested that the work might have been done by the unemployed. If the Corporation had allowed a strike to take place it would have been disastrous to a very large community. His submission was that the Hackney Borough Council had done its best, and that there had been unavoidable cause. It was impossible for the Council to avoid doing what it had done.

Mr. Hardy, for the respondent, submitted that the magistrate's judgment was correct. On March 11th Mr. Dore paid £9 for laying on the light, and on the 15th he signed the contract for the supply, and after the whole of the conditions had been fulfilled the default took place. The appellants relied on the fact that there was *force majeure*. His contention was that the meaning of *force majeure* was something not dependent upon the will of man. As applied to English contracts he said that it only applied to physical force outside the control of the contractor, and did not apply to threats merely. In this case all the work had been done except making the connection between the outside and the inside wires. What the Electrical Trades Union meant was that all should join the union, but there was no such *force majeure* as the appellants contended. Supposing a man had been dismissed for refusing to obey orders, there were plenty of skilled electricians out of work to take his place; moreover, there was no evidence that the man would have been dismissed. His contention was that a reasonable anticipation of a peril was not a *force majeure*. There was no evidence that any force was used or intended to be used.

Mr. Justice Darling said the Court had come to the conclusion that the application could not be allowed. In his judgment the magistrate was right in law. He had found that work up to a certain point had been done by men who were not members of the trade union. Everything had been put into Mr. Dore's house, making it ready for the connection, and when that came to be done the Council would not connect because persons had been employed who were not members of the trade union. If the work of connecting the main had been proceeded with, the result would probably have been that the union would have given notice to the men to terminate their engagement. The Hackney undertaking was responsible for the supply of electricity to a wide district, and the result of a strike would have been disastrous. The case was very near being a case of *force majeure*, but not quite, and the appeal must be dismissed.

The other judges concurred, and the appeal was dismissed accordingly.

Hamilton *v.* Marconi's Wireless Telegraph Co., Ltd.

In this action, which was in Mr. Justice Bray's list on Tuesday, to be heard by his Lordship and a special jury, Mr. Douglas Hogg, K.C., appearing for the defendants, applied for an adjournment. He said the application was not opposed by the plaintiff. The action was brought for the rescession of an agreement on the ground of fraud, and that was the only issue when the pleadings were closed. The case started about a year ago. On November 4th an order was made by Mr. Justice Lush in Chambers allowing the plaintiff to amend his statement of claim by adding a claim for a declaration that the agreement was illegal and void, as being in restraint of trade. That, said Mr. Hogg, was an entirely different issue. Defendants had put in a reply traversing that allegation, and Mr. Justice Lush, as a condition of leave to amend, informed plaintiff that he must not oppose any reasonable application for an adjournment. Counsel explained the reason for his application, and suggested that the adjournment should be for four weeks, to give time for mutual discovery.

Mr. Wilfred Lewis, for the plaintiff, agreed, and the hearing was accordingly adjourned for a month

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Telephony—or Telepathy?

Regarding the telephonic episode so interestingly narrated in the Electrical Review by your correspondent T. W. Best, and already the object of amusingly apt editorial banter, may I be permitted to suggest an explanatory theory?

First of all, however, it is a pity that nobody seems to have thought of verifying and corroborating the alleged occurrence by some kind of systematic reconstruction of an affair seemingly so puzzling as far as audition at the country house telephone and speech in the park glades are concerned.

The explanation, I think, is this:—

1. The telephone line through the park is faulty. If *earth* is used in the country house, there is, somewhere in the park, leakage from the single line to *earth*. If a metallic circuit has been adopted, there is, somewhere in the park, leakage between the two wires.

2. The electrically variable *fault*, whatever it may have been—whether caused by a stag fight or by a clumsily driven nail—*is acting as a microphone*. The fault, varying under the vibratory impact of any loud and emphatic speech in its immediate vicinity, causes similar variations in the current induced by the telephone magnet in the country house telephone.

Here, apparently, is a unique instance in which Dr. Bell's beautiful and simple telephone has been acting *simultaneously* as a transmitter and as a receiver.

Here, too, may be not only a basis for a new system of fault localisation, but we are here confronted by a chain of happenings affording golden grist for elaboration by any up-to-date novelist.

E. Raymond-Barker.

London.
November 14th, 1921.

Cheaper Postage.

I have read your leader with much interest.

You will be aware that considerable pressure is being brought to bear on the Postmaster-General, and that he has entrenched himself behind a statement to the effect that, while he is anxious to meet the present demand for cheaper postage, he is unable to do so without asking for a State subsidy to cover the consequent loss.

A deadlock is thus reached, and the time is opportune for a complete investigation of the proposal that the token value of the penny should be increased by 20 per cent., thus making it represent one-tenth instead of one-twelfth of the shilling.

Given a penny of this higher value, the following postal concessions would be available without calling upon the State for any subsidy:—

1. The postcard rate could be restored to one "penny" by a reduction of 20 per cent. from the present charge as compared with 33⅓ per cent. if made in terms of the present value of the penny.

2. A revised inland letter rate of 1½d. would represent an actual reduction of only 10 per cent. from the existing 2d. rate, although the public would attach considerably more value to the concession due to the continued use of the existing copper coins. From the G.P.O. point of view this reduced rate would be augmented by the increased value of the half-penny, which could still be charged "for every additional oz. or fraction thereof."

3. The restoration of the ½d. rate for printed matter could be secured at a much earlier date if the ½d. represented a value 20 per cent. higher than its present value.

4. The restoration of the 2½d. foreign postage would involve no reduction from the existing charge of 3d., since 2½ high-value pence would be exactly equal to 3 existing pence.

5. Increased revenue might be earned by the telegraph department without any alteration of the existing rate of 1d. per word.

6. A smaller number of coins would be required for telephone call-boxes.

The position in the matter of postage rates is an object lesson of the difficulties confronting all other penny-basis interests.

The public, being poorer, will no longer pay 1½d., and the producers cannot afford to restore the original penny price. The high-value penny would provide a price stage payable in one coin about midway between these two extremes.

Harry Allcock.

Manchester.
November 14th, 1921.

Electricity in Isolated Buildings.

With reference to the letter appearing in the Electrical Review of November 11th, written by Mr. R. F. Long under the heading of "Electricity in Isolated Buildings," the reading of this leads one to the impression that he is strongly opposed to the entirely hand-operated sets (what he terms older and obsolete plants); also he gives the impression (to the man who is not in touch with the trade) that the automatic plant is much cheaper both in first and running cost. Here we would state that we are manufacturing a plant which is hand-operated, is equipped with a slate switchboard containing the standard switchgear, which is necessary for the efficient control of a battery charging and lighting system, a low-speed paraffin engine, low-speed dynamo (all mounted, including switchboard, on a strong cast-iron bed), and an open-top glass cell battery at a price which is approximately £25 cheaper than the cheapest semi-automatic set at present on the market; also the running costs for fuel are 25 per cent. lower than other plants we have had experience with.

It is evident that there are other gentlemen who are tempted to write when they have "insufficient knowledge of the trend of present-day products." He also states "the fact that the semi-automatic sets are still being bought is proof that they are still wanted," but this is not proof that they have won the day over the hand-operated set, as the former have not been on the market sufficiently long to prove their absolute reliability. Further, it only needs a little thought to realise that the battery is subjected to the most severe stress when it is least capable of withstanding it; this happens, of course, when one wishes to start the set up, and the battery is already in a discharged condition. Also, even with the semi-automatic set, the human element has to intervene when it is necessary to give the battery the periodical topping charge which is essential to its long life.

There is also a further saving with the hand-operated set, *i.e.*, in the life of the lamps; here one can regulate accurately the voltage on the line, but with the semi-automatic set the voltage attains a value 30 per cent. above that for which the lamps are designed; therefore the result is quite obvious.

F. Smith.
Phœnix Ironworks Co.

Littleborough.
November 14th, 1921.

A Dynamo Problem.

I should esteem it a favour, if you would kindly offer a suggestion, through the medium of your journal, that would overcome the following trouble.

Two identical dynamos, 220 V, 90 amp., compound shunt, d.c., direct driven, are run singly or in parallel, according to loads. These machines give a fairly constant voltage from no load to full, with a small rheostat adjustment of from 2 to 6 notch (there being 24 stops in all).

One of them, however, has recently developed the contrary, viz.—As load increases, voltage decreases, and *vice versa*, to such an extent that from 50 to 80 amp. regulator has to be put over from 6 to 20 stop, with the adverse effect of lessened amperage, and apparent over-load on engine, and to attempt to move the shunt regulator any further aggravates the trouble. There is no undue heating of windings, armature, or field, or heavy sparking, and the speed remains the same. Thanking you in anticipation of a favourable suggestion.

Electron.

November 5th, 1921.

[Our correspondent has since advised us that:—
(a) Neither series nor shunt windings have been reversed.
(b) Brush position has not been changed.
(c) Insulation to earth of whole machine is 2 megohms.
(d) System is 2-wire with both poles insulated.
(e) The machine gives the same results when running on a water load.

Can any reader make a suggestion as to the cause of the trouble?—Eds. Elec. Rev.]

The Design of Switches.

In view of the disparity in the size of switches supplied by manufacturers for an equal carrying capacity, I should be pleased if any of your readers who have had experience in the manufacture of electrical accessories would be kind enough to state the generally accepted standard of contact area for unit current.

Seager.

November 14th, 1921.

The E.P.E.A. and the E.T.U.

The attention of my Committee has been drawn to the statements in the technical Press as to what happened at the meeting of the National Joint Board with respect to an agreement between the Electrical Power Engineers' Association and the Electrical Trades Union. The facts of the case are these: An agreement was entered into between my organisation and the Electrical Power Engineers' Association, provided that agreement could be arrived at on lines of demarcation of membership. Agreement has not been reached on the said point, and, therefore, there is no agreement between the two bodies.

I have asked our General Secretary, Mr. Rowan, to confirm this statement.

W. J. Webb,
London District Secretary, Electrical Trades Union.

London.
November 11th, 1921.

The Durability of Lead-covered Wiring.

I have noted with considerable interest the several letters which have appeared in your columns on the above subject. May I say that, with reasonably extensive experience of the well-known lead-covered wiring systems, I cannot think of any trouble having occurred, except from direct mechanical damage.

I agree with Mr. Alldread that efficient bonding and earthing are essential, and on one or two systems, notably that designed by Johnson & Phillips, it might be said that inefficient bonding is almost out of the question.

I would certainly say with "Contractor's Foreman" that solid-drawn conduit and high-grade v.i.r. provide the most reliable job, but here comes in the strong point of the lead-covered system, that is, reasonably high efficiency at a very moderate cost.

In your advertisement columns recently an advertisement appeared which illustrated a booklet descriptive of a wiring system, and suggested: "Apply for this booklet and get busy." At the present time one can often persuade a potential consumer to go ahead after the economy of the lead-covered system has been demonstrated, whereas the higher-priced, but more desirable, conduit job would have had to wait for better times.

Contractor.

November 8th, 1921.

The recent correspondence on the subject of the durability of lead-covered cable has been very interesting and instructive to one who is engaged in the testing and inspection of all classes of installations.

There is no doubt whatever that only the best quality of C.M.A. lead-sheathed cable and fittings should be used. The bonding at fittings and to earth should be very carefully carried out, with a view to the efficient maintenance of a low resistance path to earth for any leakage current. Many installations at the outset give a good bonding test, but what result would be obtained, say, three years after the installation was completed? In this connection, the advantage of having a regular inspection made of the installation by an approved company will be apparent to all users of electricity, whether for lighting or power purposes.

The writer recently came across an installation wired with a new type of lead-sheathed cable, consisting of a sheathing of very thin sheet lead, merely wrapped round the cable with a longitudinal lap joint, and covered with a spiral armouring of aluminium strip. As this cable has no solid-drawn sheathing, it cannot be claimed that it is suitable for any but very dry stations, and, moreover, this type of cable will stand very little bending without cracking the sheet lead covering. The difficulty of satisfactorily bonding this cable to fittings is very real, and unless the aluminium strip is very carefully finished off there will be a danger of earthing switch and ceiling rose terminals. Another point in connection with this type of cable is the possibility of electro-chemical action taking place between the lead sheathing and the aluminium armouring. As aluminium is electro-positive to lead, under certain conditions, electro-chemical action would be inevitable. Altogether this type of cable appears to the writer to be a very unsuitable one for house wiring purposes.

A lead-sheathed cable should certainly have a solid-drawn sheathing, and the durability of such a cable manufactured by a reputable firm cannot be denied.

The sheathing of the cable of the various wiring systems is not of pure lead, but of a lead alloy, in order to obtain a stiffer cable, and one less liable to sag from ceilings and walls, but the durability of this alloy will probably not be equal to that of lead in any but very dry situations.

It should be obvious to engineers that unless lead-sheathed cable is enclosed in tubing when fixed in plaster, in the event of a fault developing in that particular circuit, it would be impossible to re-wire the circuit without damaging the plaster, hence the necessity for such a rule which is found in many wiring regulations.

Inspector.

Manchester.
November 14th, 1921.

Being a constant reader of your paper, and being interested in the discussion appearing therein regarding lead-covered wiring, I wish to give my personal experience with it.

Having for some time used continually Henley's lead-covered wire, and having found this wire faultless in whatever situation installed, I cannot see why this system of wiring should be doubted for general use with reliability.

One great point I have found is that wire bought on reels is much more satisfactory than that bought loose, or rather, wrapped round with canvas. Only a few weeks ago I wanted to try another maker's wire, and when I received it I found it so badly kinked and knocked about in transit that I at once altered my mind. A contractor also knows from experience that lead-covered wire requires more careful handling than any other wiring system, and finding it hard to get hold of a man to be trusted with it, one is at his wit's end to know what to do.

I have found many bad cases relating to bad workmanship, some of which I give, for instance:—

(*a*) Joint boxes omitted under floors, etc., in which cases ordinary ceiling roses or cut-outs are substituted, or simply taped connections made without even soldering or using porcelain connectors.

(*b*) Insufficient saddles or fixing clips used, especially on ceilings or places where the wire has to hang, this kind of thing resulting in loose loops, which undoubtedly tends to strain the lead sheathing.

(*c*) Places where the wire or wires have to follow some ornamental picture railing or the like, and are bent so acutely that the lead sheathing has kinked or even cracked, which afterwards generally results in the sheathing making contact with the internal wires.

(*d*) Lead case not sufficiently bared off at ceiling roses or switches, and having been pierced with the fixing screws of the block itself.

(*e*) In damp and exposed situations iron nails have been used, these rusting and setting up electrolysis, and very soon causing failure altogether.

(*f*) Contact with iron gas or water pipes, these pipes being rusty or corroded.

(*g*) Wiring let into walls, etc., without some metallic protection against damage, such as nails being driven into the walls for pictures.

(*h*) And finally, no earth connection made to lead sheathing, nor even continuity of the sheathing itself ensured.

These faults, when found and witnessed by the consumer, soon convince him that the system is in no way perfect, and this kind of thing soon spreads to the would-be consumer, not encouraging him to install lead-covered wire.

I consider that there is no excuse for this neglect or bad workmanship, because if one takes advantage of the Henley system for instance (which provides the suitable metallic sheathing and all requisite fittings), he will see that it is as good, if not better, than any conduit system, provided it is installed by a competent electrician.

For neatness, in my opinion, there is nothing to come up to lead-covered wire, and it is by no means expensive. I should like finally to say that I could personally show people installations wired by myself with Henley's system, that have been in use for some considerable time, and have never given me or the consumer any trouble.

W. A. Allwright,
Electrical Engineer.

Lewes, Sussex.
November 14th, 1921.

A Change-over from d.c. to a.c.

It will be interesting to have the experience of engineers who have changed-over single conductors, lead-covered, from d.c. to a.c. One would expect that the induced currents in such wiring would cause trouble, and even the possibility of the heating of the covering. Possibly where the current in the wiring is small, say, an ampere or under, the effect may be negligible, but one would expect that in circuits run for fires, &c., where the currents are heavy, the chances of trouble would be greatly increased.

The opinions of those who have gone into the matter would oblige.

Lead Covered.

November 10th, 1921.

A New Dynamo.

We are rather surprised at the contents of one of your leading articles in your issue of November 4th, headed "A New Dynamo." On the report you gave the writer made a special journey to see this dynamo, and considers your report misleading; in fact, we do not think it a practical proposition. Even if it could be constructed on commercial lines, it does not require much time to prove that it would increase the cost of building rather than decrease it. The weight of the machine must be greater, not less; the motor cannot be run faster, at present, than the standard design permits; and the efficiency must be considerably lower.

All the above remarks are compared with modern practice on interpole motors and dynamos.

W. F. Higgs,
Higgs Brothers.

Birmingham.
November 11th, 1921.

[We regret that Mr. Higgs considers his journey wasted; we, however, are not responsible for that. Our article was written in the conditional mood throughout, and clearly indicated that the invention was in the experimental stage. In passing, we would point out that the machine can be seen only by invitation of Mr. Sayers, and is not open to public inspection; it is regrettable that Mr. Higgs should have publicly subjected it to adverse criticism after a private inspection, seeing that the inventor is debarred from divulging details and refuting his criticism at the present stage.

With regard to the merits of the invention, apart from the fact that Mr. Sayers is a dynamo designer of over 30 years' experience, we have ourselves thoroughly inspected the models, and the designs for larger machines, and while we have foreseen difficulties, which had not escaped the inventor's

notice, we believe the device is well worth trying on a larger scale. We understand that some of the manufacturing experts who have had a private view of the invention have paid two and even three visits, showing that they, at any rate, did not consider their first journey wasted. So many devices which were condemned in their early stages have proved "practical propositions" that it is risky to dismiss new ideas off-hand.—Eds. Elec. Rev.]

The I.E.E. Informal Meetings.

I am sorry to notice in your current issue several inaccuracies in the leaderette on the subject of the Informal Meetings Section of the Institution. This leaderette contains certain misstatements which I should be glad if you would correct in your next issue, as otherwise the article in question is likely to do harm to the movement, and this I feel sure you would not wish.

In the first place, you indicate that the meetings will be held in the "dignified surroundings of the theatre of the Institution." The meetings will actually be held in the tea room, where smoking, as hitherto, can be allowed.

The Committee has not relaxed the rule (made by the Council) that there shall be no publication of the speeches made at these informal meetings, and the appointment of a member to supply an official summary to the Press was decided upon in order that the Press might be relieved of the responsibility for publishing anything which the Institution might prefer should be withheld from publication.

The conduct of the meetings will be exactly as hitherto, including the break for refreshments during the discussion. This, I think, was amply proved by the meeting held last night, and will be confirmed on reference to any member of your staff who may have been present.

There is no desire or intention on the part of the Council or the management of the Informal Meetings Section to make the meetings of this Section more formal and consequently less likely to serve the purpose for which they were instituted than when the meetings were, of necessity, held away from our own building.

I will add that I am, at all times, ready to give any representative of the Technical Press correct information regarding the proceedings of the Informal Meetings Section of the Institution.

F. Pooley.

Westminster.
November 8th, 1921.

Chairman, Informal Meetings Section, I.E.E.

[Mr. Pooley has evidently misunderstood the purport of our leaderette; it was obviously written to *prevent* harm to the movement, which has nowhere received more wholehearted support than in our columns. In vindication of our comments, we may point out that the "Informal Meeting" of January 24th last was held in the theatre of the Institution of Civil Engineers, with Mr. Pooley in the chair; if, as is not unlikely, the meetings at headquarters become too large for the tea-room, they will no doubt be held in the theatre. The receipt of an official report of the last meeting, comprising some 900 words, and summarising the remarks of seven of the speakers besides the President's, confirms our reference to the relaxation of the rule of "No Publication of Speeches." The Press was well aware of the rule, and so far as we know, had no desire to be relieved of the responsibility for publishing reports which it did not intend to publish. For the rest, we expressed the hope that the Committee would jealously safeguard the amenities of these informal meetings; that hope we continue to cherish.—Eds. Elec. Rev.]

BUSINESS NOTES.

Bankruptcy Proceedings.—Frederick Alfred Stanley Wormull, 273, High Street, Lewisham, trading as the Lewisham Electric Wiring Co., electrical engineer.—The first meeting of creditors was held on November 8th at 29, Russell Square, W.C.1. The causes of failure, as stated by debtor, were heavy administrative expenses, lack of proper supervision of outdoor staff, losses incurred through inaccurate tendering for contracts carried out, together with the general trade depression. In January, 1919, with a capital of £200, he started business in the name of the Lewisham Electric Wiring Co., at 273, High Street, Lewisham (rental £50 a year), but from accounts prepared by an accountant the business was carried on at a loss of £707 to December 31st, 1920. The estimated trading loss since that date was £1,049. The first legal process issued against him was in February, 1921, and at the date of the receiving order five creditors for £103 had obtained judgment. The unsecured liabilities included £2,584 to the debtor's wife for cash advanced, apparently for the purpose of the business; £33 18s. 5d. to other cash creditors, and £144 12s. 1d. to trade creditors. The statement of affairs showed gross liabilities £2,834, of which £2,762 was expected to rank. The net assets were estimated to produce £260, thus showing a deficiency of £2,502. The case was left in the hands of the Official Receiver.

J. Owen (J. Owen & Sons), electrical engineer, 186, Westcombe Hill, and 3, The Grove, Greenwich, S.E., electrical engineer.—Receiving order made November 7th on debtor's own petition. First meeting November 18th at Russell Square, W.C.1. Public examination December 20th at the Court House, Greenwich, S.E.

John Edward Adolph Bradbury, 11, Dean Park Road, Bournemouth, Hampshire, director of companies.—The adjourned public examination of this debtor was held recently at Bournemouth. The statement of affairs showed liabilities amounting to £9,367, and assets amounting to £682, leaving a deficiency of £8,685. The debtor attributed his failure to depreciation in the value of shares, and losses in connection with an electrical supply business with which he was concerned, &c. The debtor started a venture called the Electrical Goods Supply Co., and he was joined by another, debtor finding £960. The debtor alleged that while he was away in April of last year he lost quite £1,205. After questions had been asked the examination was adjourned.

George Williams Endall, trading as Endall & Co., Canal Motor Works, Canal Bridge, Church Street, St. Helens, Lancs., electrical, mechanical, and automobile engineer.—The public examination of this debtor was held on November 7th at Liverpool. Debtor was ordered to amend his deficiency account, and the examination was adjourned.

Dissolutions of Partnership.—Sheffield Accumulator Co., Broom Street, Sheffield.—Mr. W. T. Baldwin and Mr. J. S. White have dissolved partnership. Mr. W. T. Baldwin will attend to debts and continue the business.

Slater Bros., Electrical Engineers, 25, Dickinson Street, Manchester.—Messrs. T. G. Slater and G. Slater have dissolved partnership. Mr. T. G. Slater will attend to debts, and continue the business under the same style.

Receiver Appointed.—S. Gillitt & Co., Ltd., electrical engineers and contractors, 33, Groat Market, Newcastle-upon-Tyne.—Mr. A. E. Dees has been appointed receiver on behalf of the debenture holders, and is at present carrying on the business in that capacity.

Trade Announcements.—The Belfast depôt of the Edison Swan Electric Co., Ltd., has now been removed to more commodious premises at 41, Chichester Street, and all communications for the branch should be sent there.

Mr. A. R. Fox has commenced business as an electrical and mechanical engineer at 19, Lowden Avenue, Chippenham, Wilts. He wishes to receive catalogues and price lists.

Mr. E. Fuggle has been appointed manager of the electrical business of Wellman Brothers, 57, St. Leonard's Road, Windsor.

Catalogues and Lists.—Messrs. Belling & Co., Derby Road Works, Edmonton, N.18.—A large coloured poster depicting a lady warming herself at a "Belling" fire.

Mr. J. B. Rudkin (representing Sprecher & Schuh Co., Switzerland), 212a, Shaftesbury Avenue, W.C. 2.—List No. 1, giving illustrations and dimensions of quick-and-slow-break knife switches. Priced in Swiss francs.

The Mirrlees Watson Co., Ltd., Scotland Street, Glasgow.—B Sheets 1,751 and 1,752, illustrating and describing, respectively, a multi-injector air pump and a surface condenser.

Messrs. Siemens Bros. & Co., Ltd., Caxton House, Westminster, S.W.1.—Pamphlet 730a, illustrating and describing luminous signalling apparatus for power stations, &c.

Messrs. Ferranti, Ltd., 180, Fleet Street, E.C.4.—Leaflet MTG/508, giving examples of castings in "No-Mag" non-magnetic iron.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Three leaflets, No. 2,659, giving particulars, with illustrations, of the G.E.C. showroom service; and Nos. F 2,636 and 2,660, lists of revised prices of fixtures and accessories.

The Globe Engineering Co., Ltd., Perseverance Works, Brighouse.—List No. 3, giving illustrations, dimensions, and prices of protected type a.c. motors and dynamos.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., U.S.A.—*Contact*, a magazine dealing with salesmanship in connection with electrical appliances.

Swedish General Electric Ltd., 5, Chancery Lane, W.C.2.—Stock list (No. 110) of d.c. and single-phase a.c. motors, and Stock list (No. 110a) of two and three-phase a.c. motors. Both lists are fully priced. Also a descriptive list of electrical equipments for the printing and allied trades.

Messrs. Reavell & Co., Ranelagh Works, Ipswich.—Pamphlet No. 100, illustrating and describing rolling drum type rotary air compressors and vacuum pumps.

Bell's United Asbestos Co., Ltd., Southwark Street, S.E.1.—An illustrated folder giving examples and descriptions of several kinds of asbestos insulating compounds.

Electric Cooking at Glasgow.—As we recently announced, the Corporation of Glasgow has, in order to encourage the use of electricity in the home, decided to hire out certain domestic apparatus, includnig electric cookers. A batch of them has just been completed and dispatched to Glasgow; they are of the No. 20 type manufactured by the Jackson Electric Stove Co., Ltd. Details are as follows:—

The whole outfit is heavily constructed of cast iron and steel. The oven has an actual cooking space (not total size of the oven, which is often given and is misleading), of 14½ in. high, 12¾ in. wide and 15 in. deep. It is loaded to 1,600 watts with three-heat regulation. The oven is double-cased and lagged on all sides, including the door. The switch is fitted in a convenient position and is arranged for three-heat regulation.

The hob, which is mounted above the oven, contains two open-type boiling plates, each with three-heat regulation, and a grill loaded to 1,500 watts, with a single heat.

There is no mica of any description employed in this cooker. There are no loose leads, beaded wires, or asbestos-covered wires; all connections are of the solid rod type mounted on porcelain insulators—in fact the connections resemble the back of an ordinary switchboard. The leads, therefore, need no further attention once they are built in position, the only adjustments that may be occasionally necessary are the elements, these being extremely simple to replace. The hob lifts without the necessity of undoing screws or bolts, and an element can be replaced by an unskilled person. The boiling plates consist of three elements which are connected as follows:— On full heat each element is in parallel. On medium heat the two outside elements are in parallel. On low heat the centre element is in series with the two outers. This ingenious method causes an out of balance current from the centre element which glows a dull red, the two outer elements being black although under heat.

Should an element fail it is a simple matter to wind a new spiral on the existing former at the cost of a few pence; one element being out of commission does not affect the other two. Large quantities of liquid can be deliberately thrown over these elements when glowing at full heat, without fracture or damage, and the cookers can be subjected to a flash test of 2,000 volts to earth.

The fuses of each section are fitted above the switches and are of the D. & S. Home Office type.

During the last two weeks of October, 173 No. 20 cookers were dispatched by the makers for various hiring and housing schemes in this country, and over 40 of the No. 21 type.

The dimensions of the No. 20 cooker complete are: 34 by 26¾ by 21¾ in., and its net weight is 234 lb., that of the hob only being 86 lb.

Store Lighting.—The accompanying illustration shows a very effective lighting scheme which has been carried out by Messrs. F. Sage & Co., Ltd., at the Galeries Lafayette, Regent Street, W. The illumination is provided by "Osram" lamps sunk in elaborate plaster mouldings, and in this way

An "Osram" Lighting Scheme.

the lighting forms an integral part of the scheme of decoration. In order that the effect should not be marred by uneven brilliance, each lamp was specially tested. Over 15,000 20-watt and 1,000 40-watt lamps were used in this scheme.

Social Events.—Messrs. S. Charlesworth & Co., of Oldham, held their annual dinner on November 9th at the Café Monica. The toasts of "the Firm" and "the Visitors" were duly honoured. A whist drive was held, and the remainder of the evening was spent in song and dance.

Unemployment.—The latest available returns of the number of persons unemployed show a further increase for the week ended November 4th. Upon this date the total was 1,722,800, as against 1,611,476 upon October 28th. The increase is again said to be due to re-registration for benefit by those whose previous term had expired. On October 28th workers on short time numbered 251,606, a slight decrease for the week.

Our Foreign Trade.—October Figures.—The following were the values of imports and exports of electrical goods and machinery during October, 1921:—

	Oct. 1921.	Inc. or dec.	10 months, 1921 Inc. or dec.
Imports.—	£	£	£
Electrical goods and apparatus	105,024	−130,292	+373,565
Machinery	140,423	−1,412,791	−7,009,856
Exports.—			
Electrical goods and apparatus	894,196	−164,577	+2,477,763
Machinery	1,747,650	−503,676	+14,862,664
Re-exports.—			
Electrical goods and apparatus	11,133	−3,522	+73,543
Machinery	90,742	−87,464	−323,344

Trade Conditions in Western Canada.—H.M. Trade Comsioner in Winnipeg (Mr. L. B. Beale) reporting to the Department of Overseas Trade on the trade conditions of Western Canada, as at the beginning of October, in dealing with general hardware, states that "British manufacturers are regaining their pre-war trade to Canada by going after the business, visiting the Dominion and giving the market just what it wants at a competitive price. What is equally important, British manufacturers are now securing trade here in lines never before exported to Canada, but in which the U.S.A. held practically a monopoly. The importing hardware traders of Western Canada are extremely pleased with our success, and would welcome still more aggressive methods on our part, which undoubtedly would reap the reward of greatly increased business." Of general trade conditions, Mr. Beale reports that while they remain quiet at the moment, the indications are that business has improved during the past few months and that better times are ahead.

The period of transition offers a good opportunity for British manufacturers to enter the market. With the appreciation of the American dollar and the depreciation of the pound sterling, and the ready willingness of United Kingdom manufacturers to suit the market's requirements, Canadian business men are looking to the United Kingdom to supply their wants. In the last few months ample evidence of this fact has been afforded, and inquiries for British sources of supply of goods, previously obtained from the United States, are on the increase. The United States Emergency Tariff Act, by its effect on Canadian export trade, has done nothing to improve the trade sentiment between the two countries. The Canadian business man is prepared to welcome British manufacturers in the West, but it is essential for British manufacturers personally to study the market, and make an effort to supply its requirements.

So important is the general development of British Columbia considered by the Dominion Government, that a branch of the Department of Trade and Commerce has been opened in Vancouver to study and make a complete survey of every feature of export trade on the Pacific Coast.

E.D.A. Activities.—The aim of the latest pamphlet (E.D.A. No. 215) published by the British Electrical Development Association is to emphasise the great gulf between good and bad lighting. It is pointed out that the incorrect use of electricity for lighting is likely to lead non-users to consider it inferior to other agents in this respect. The front of the pamphlet depicts three methods of lighting in contrast—good, bad, and indifferent.

We are reminded of the imminence of Christmas by another bunch of pamphlets from the E.D.A., which advocates electrical presents in an attractive way. Two of the leaflets are in verse which, while not exactly Miltonian, presents a good case for electricity. In one of these the democratic nature of electricity is made plain by the lines:— "And brings ye yokel and ye squire close to ye central station."

Local Electrical Exhibitions.—Messrs. Cross Bros., Ltd., a Cardiff ironmongery firm, have opened a new department devoted to heating, lighting, and electrically-operated labour-saving devices for use in the home. Demonstrations are given of the utility of electrical washing machines, cooking ranges, tea and coffee urns, radiators, vacuum cleaners, &c. Lady shoppers are shown that it is possible with an electric washer to get through a week's washing for a family of six in one hour. The demonstrations attracted large crowds of visitors.

Commencing to-day and continuing to December 3rd, the Newcastle-upon-Tyne Electric Supply Co., Ltd., is contributing largely to a "Housing and Home Life Economy Exhibition" at Newcastle. Other firms exhibiting electrical appliances are Messrs. Siemens Bros. and Co., Ltd., The Northern Steel & Hardware, Ltd., of Manchester, and three local firms: Messrs. Robson & Coleman, Gray Bros., and Electrical Devices, Ltd.

Foreign Electrical Engineers Invited to Russia.—It is stated in a North Russian paper that foreigners who have worked in Russia in the electrical industries and subsequently left the country, if they wish to return to Russia to resume work, can be immediately admitted, and should make application to the foreign representatives of the Russian Government in their respective countries in due form.

Germans in China.—In his report on the commercial situation in China as at June last, Mr. H. H. Fox, commercial counsellor at H.M. Legation at Peking, says that the Germans are gradually returning to China and picking up the threads of their former business; they are not, so far as can be ascertained, trading under their own names, but are carrying on their business in partnership with Chinese. German dyes and paints, needles, metals, drugs and sundries are beginning to appear on the Shanghai market, and it is reported that several important orders for machinery and electrical plant have recently been booked by German firms. Germany has recently purchased fairly large quantities of Chinese produce, notably, ores, seeds and oils, but the business has been done through foreign firms owing to the difficulty the Germans are experiencing in financing their shipments. There is no doubt that the Germans, assisted by the comparative cheapness of their products, will gradually recover the share they held in China's foreign trade before the war, but the process will be slow, as they have lost valuable connections; the business organisations they had so laboriously built up have been shattered, and they have suffered a serious loss of prestige in the eyes of the Chinese.—*Board of Trade Journal.*

Rubber.—At the meeting of the Institution of Rubber Industry, on Wednesday, Dr. Henry P. Stevens read a paper on "Plantation Rubber," and dealt with the many difficulties at present associated with its handling and manufacture.

Price Reductions.—The Swedish General Electric, Ltd., announces considerable reductions in the prices of "Century" single-phase repulsion induction motors.

The Claim Against the Sydney City Council.—The recommendation authorising negotiations with the English Electric Co., Ltd., with a view to obtaining a quotation for the supply of a 12,000 kW turbo-alternator and two rotary converters was amended by the City Council as follows: "That tenders be invited for supply of the plant in the usual manner."—*Tenders.*

Book Notices.—"Bulletin of the Cleveland Technical Institute." Compiled and edited by the director and secretary, Edward L. Johnson, F.G.S., Vol. 1, No. 1, October. Middlesbrough: The Institute. This is the first issue of a monthly periodical containing abstracts of the most important scientific and technical articles published during the month. It is printed on one side of the paper only, to enable the items to be pasted to cards, to form an index. It deals with many subjects, including electrical engineering, fuel technology, foundry practice, &c.

The McGraw-Hill Publishing Co., Ltd., 6 and 8, Bouverie Street, E.C.4, has sent us a catalogue of technical and scientific books. This list gives the size and price of each book, with a brief review of the contents, and the company expresses its readiness to send copies of the catalogue to any who desire them.

Technologic Paper No. 199 of the U.S. Bureau of Standards, "Method for Precision Test of Large Capacity Scales." Washington: Government Printing Office. Price 5 cents. This paper outlines a method used for testing railroad master and grain hopper scales.

"M. and C. Machine Mining." Vol. I. No. 4. Glasgow: Mavor & Coulson, Ltd. Price 6d., post free. This issue contains, *inter alia*, "Notes on Coal-cutter Fitting": a description of "universal headers" or "punchers"; and aids to the erection of switchboards.

"Transactions of the South African Institute of Electrical Engineers. Vol. XII., Part 9, September, 1921. Johannesburg: The Institute. Price 2s. net.—This issue includes "Notes on Radiography," by H. G. Symons, and discussions on several previously published papers.

Wages Reductions in Sweden.—Notices were posted last week at the Ludvika works of the Svenska Allmanna Co. announcing wages reductions, as from November 14th, of 15 per cent. for mechanics, and 20 per cent. for packers and warehousemen, while the salaries of officials will be curtailed by 20 per cent. as from February 1st next.

Insurance of Diesel Engines.—The amended arrangements made by the Insurance Committee of the Diesel Engine Users' Association for the insurance of Diesel engines against breakdown, including periodical inspection and reports by engineers having special Diesel engine experience, were reported at the last meeting of the Association. The standard form of policy which was adopted by the Association some six years ago has been amended in some respects as a result of experience gained.

A very important provision under the Standard Policy is that which provides for arbitration in the event of a dispute without having recourse to the expensive method of proceeding under the Arbitration Act.

Inquiries.—Electric Hot-water Geyser.—A correspondent asks for the manufacturers of spare parts for the electric geysers originally made by the British Electric Heater Co., of Glasgow, under patent 25,296/09.

"Sunstone" Electric Bowl Fittings.—A correspondent seeks the name of the manufacturer or supplier of these fittings.

The Electrical Trades Union.—Suspension of the London District Committee.—We have received a circular dated November 8th, 1921, which is signed by Mr. J. W. Ball (General President), and Mr. J. Rowan (General Secretary) of the E.T.U., and states that after most grave consideration the executive has been compelled to suspend the London District Committee. This is the culmination of years of continued violation of the constitution, and defiance of the authority of the Executive by the London District Committee. The chief reasons for the suspension are:—

(1) Repeatedly instructing members to cease work without either consulting the members involved or obtaining the sanction of the Executive Council.
(2) Ordering strikes without making the slightest attempt at preparation, as witness, Ponders End, Greenwich, and London shipping strikes.
(3) Breaking the rules by circularising branches time and again in defiance of the Executive Council.
(4) Bringing the union and its officials into discredit by publishing broadcast in the *Electron* statements and insinuations, regardless of the rules prohibiting this.
(5) Laying bare to the employers (whom it specially enjoins to read the *Electron*) the internal business of the union.
(6) Conducting a campaign of vilification against officials and members who endeavoured to stop such irregularities, as witness the cowardly attacks on Bros. Morton and Bussey, of the Station Engineer Branches.
(7) Compromising the union and its railway members by making an agreement with the National Union of Railwaymen without authority, which agreement is now being used against the union in several districts.
(8) Antagonising the station engineer members by making them the butt of every industrial dispute.
(9) Destroying the financial stability of the union by reckless expenditure. Had other district committees followed this example the union would have been broken long ago.
(10) By its instructions debarring members from voting for or against amalgamation with other engineering unions.
(11) Committing the members to affiliation with the Red International despite the adverse vote of the branches.
(12) Authorising the payment of strike committee fees far in excess of the rules, leaving members in other districts to fare as best they could."

A circular from the London D.C. purporting to be a reply to the Investigation Committee's report on the London district finance is alleged to "teem with gross untruths, scurrilous abuse, and vile personalities."

The District Committee is said to have antagonised other trade unions by seeking to organise workers not even remotely connected with electrical work, and at Ponder's End to have disgusted members so much that most of these left the union immediately the strike was finished.

"In no district in the union have the rank and file had less real control than in London. The district committee has treated them with absolute contempt and disdain, and many branches are in revolt."

Pointing out that the next few weeks may decide the destiny of the Union, the Executive calls for the unwavering support of the members in general and the London members in particular to place the Union on a foundation of stability.

For Sale.—Aldershot Urban District Council Electricity Department invites offers for one direct-coupled 4-cylinder, 135-kW Carel-Peebles Diesel set.

The Neckar Hydro-Electric Works.—The Neckar Works Co., of Stuttgart, which has now commenced the construction of hydro-electric works, has just raised a 5 per cent. loan which has been over-subscribed, and amounts, as accepted, to 450,000,000 marks. With the ordinary share capital of 300 millions and the contributions of 300 millions by the Reich and by Federal States, the total available capital exceeds one milliard of marks.

Catalogues Wanted.—Messrs. Aspinall & Co., electrical engineers, 63, North Street, Lockwood, Huddersfield, wish to receive catalogues of lamps, domestic appliances, motor car lighting and starting equipment, &c.

The Batti-Wallahs' Society.—At the luncheon held on Monday at the Holborn Restaurant, Mr. A. G. Deverill entertained the company by emitting "sparks from Deverill's Brush." The first informal evening of the Society took place at the Engineers' Club, Coventry Street, on Wednesday.

A New German Lamp Factory.—The Wolfram Lamp Co., of Augsburg, whose factory was destroyed by fire, has acquired a new site for the erection of a works, which is to be ready in the middle of next year, and to have a productive capacity of 3,000,000 lamps per annum.

Ediswan Wiring System.—At the invitation of Mr. A. E. Smith, District Superintendent of the Edison-Swan Electric Co., Ltd., a party of 72, consisting of the leading electrical engineers of the district and their men, assembled at the company's showrooms at Hull, on Monday evening last, to hear and discuss a lecture on the Ediswan Wiring System by Mr. F. C. Raphael. Many practical points were raised in the discussion, which was wound up by Mr. Herbert Bell, O.B.E., the city electrical engineer, who expressed the opinion that some form of surface wiring system was essential in many cases to reduce the cost of electrical installations.

Adjustment of Wages in the Electricity Supply Industry.—The following agreement with regard to the adjustment of wages, issued by the National Council for the Electricity Supply Industry on the 4th inst., has been circulated:—

1. That the National Council adopt the principle of a sliding scale of wages, in accordance with the Board of Trade index figure of the cost of living as published monthly in the *Labour Gazette*.

2. That the datum figure be 120 per cent. above the July, 1914, figure, as published in the *Labour Gazette*.

3. That the next wages revision shall take place as from November 15th, 1921, based upon the cost of living index figure as published in the *Labour Gazette* in October, 1921 (110).

4. That the next following wages revision shall take place as from January 1st, 1922, based upon the cost of living index figure as published in the *Labour Gazette* in December, 1921.

5. That there shall be a three-monthly revision thereafter, based upon the average cost of living index figure as published in the *Labour Gazette* for the three preceding months.

6. That the method of variation, up or down, shall be an increase or a decrease respectively of ¼d. per hour for every completed six points, calculated from the datum figure of 120.

7. That this agreement shall be subject to termination at the end of any period of three months by either party giving to the Secretary three months' notice in writing to that effect, but no such notice shall be given prior to March 31st, 1922.

8. That nothing in this agreement shall be deemed to alter the basic rates for the purposes of superannuation.

As stated above, the cost of living index figure for October was 110, *i.e.*, a fall of 10 points from the datum figure of 120. In accordance with Clause 6, there will therefore be a reduction of ¼d. per hour (for the complete six points) as from November 15th, leaving four points to carry forward to the next revision, which will be based upon the cost of living figure for December.

Surrender of Accumulator Patents.—Notice is given in the *London Gazette* of November 11th, that Batteries, Ltd., has offered to surrender the undermentioned Letters Patent granted to Svenska Ackumulator Aktiebolaget Jungner:—No. 5,545 of 1912 for "Process of manufacturing negative electrodes for alkaline accumulators," No. 72 of 1914 for "Process for restoring the activity of a positive electrode mass for alkaline accumulators"; and No. 123 of 1914 for "Improvements relating to electric accumulator cells."

Lantern Slides.—Messrs. Boving & Co., Ltd., have a complete new set of lantern slides showing examples of modern water turbines and hydro-electric installations, which they will lend to responsible members of institutes, technical schools, &c., for lecture purposes on request.

Commercial Research Fellowships.—The Executive Council of the British Empire Exhibition has approved a scheme for establishing five or more Commercial Research Fellowships in connection with the exhibition, for competition among Chambers of Commerce in the United Kingdom. The value of each Fellowship will be not less than £500, and will include a first-class return passage to the Dominion, Crown Colony, &c., to which the Fellow will proceed. The subjects of research will be as follows:—

The best means of promoting inter-Imperial trade in a selected staple industry.

The methods whereby the British Empire Exhibition can further the interests of this trade.

The potential resources in raw materials, &c., in the Dominion or Crown Colony visited, and the best means for exploiting these in the mutual interest of the Dominion and this country.

The means whereby these undeveloped resourecs may be adequately represented at the British Empire Exhibition and brought to the attention of interested financial or industrial groups. The closing date for entry on the part of local Chambers of Commerce will be December 15th.—*Daily Telegraph.*

Japanese Visitors.—It is stated that about the middle of December an important commercial delegation from Japan will arrive in England. The London Chamber of Commerce will give it a reception during its stay here.

A Mission from Cuba.—H.M. Government entertained Gen. M. Menocal and the other members of the Cuban mission, now on a visit to this country, at a dinner given on Thursday last week. The General referred to the fact that Cuba purchased British manufactures because they were to its liking, and because they were excellent. The mission had verified the many possibilities of business development between Cuba and the United Kingdom. Visits were recently paid to provincial industrial centres.

Settlement of a Strike in the Rubber Industry.—A strike affecting 10,000 india-rubber workers, largely women and girls, and mostly members of the Amalgamated Society of India-rubber Cable and Asbestos Workers, in the Manchester, Oldham, and Hyde districts, was settled on 11th inst. by a workers' mass meeting vote in favour of compromise terms.

The strike started a few days earlier on the rejection of a proposal by the employers, who are members of the India-rubber Manufacturers' Association, that the working hours of 47 per week should be increased to 52½ per week without alteration of wages. The union were willing to accept a wages reduction of 5 per cent., but were firmly opposed to any interference with the shorter hours they had gained during the war. There is to be an advance of one hour only in the length of the working week and a reduction of 7½ per cent. in wage rates.—*The Times.*

Trade with India.—There will shortly be published by the Department of Overseas Trade a review by Mr. T. M. Ainscough, O.B.E., H.M. Senior Trade Commissioner in India and Ceylon, of the conditions of British trade in India during the years 1919/1920 and 1920/21, revised to October 1921, and the prospects for the future. The report deals with a most interesting and abnormal period, and the mass of information (the report covers over 350 quarto pages), if properly read and digested, will go far towards assisting traders to form their conclusions from the general tendencies which are gradually shaping themselves and which will in due course crystallise into the future normal position. Conditions have, in many instances, undergone radical changes, and a new India, in a commercial sense, has been, and still is, in the course of development.

The Premier on Signs of Trade Revival.—In the course of his speech at the Lord Mayor's Banquet, the Prime Minister referred to a number of favourable symptoms of the trade situation. The first was the fact that the great glut of products which followed the 1920 boom was being liquidated. That was a very important element in trade revival, as until those goods had been disposed of there was no room for more. The world needed goods and British goods, and it would get them. "To those too impoverished to pay we hope to help to give an upward fillip by our new exports credit scheme and trade facilities. But that is not what will produce a restoration of trade. Work alone will fill the depleted tills of the world. You have got to create purchasing power. That is what we have got to look to, and I, therefore, come to the second favourable symptom. In every land the dazed slackness that seemed to have overcome labour is passing away. It is true of every country that has been engaged in the war. These are the reports we get. It is altogether true of our own country. I hear reports from employers of a perceptible improvement in the quality and quantity of work which is being put in. That is what in the end will recreate industry, trade, and commerce. The world is everywhere settling down to work. By that means you not only increase wealth, but you reduce cost; and that is vital. The third favourable symptom is this:—In this country the foundations of our credit are solid and uncracked. . . . I think our reward is coming. It is coming slowly. It is, perhaps, crawling, but when you see anything coming at a distance it always looks as though it were crawling. But the soundness of our commerce and industry and financial policy has been vindicated. Prosperity, when it comes, can walk without fear of hidden trap-doors. Our exports in October were better than they have been since the month of March. Orders are beginning to flow in from the deluged lands, and the blue sky is beginning to emerge."

An Effect of the Exchange Situation.—An important Basle firm, Haefeli & Co., manufacturers of electrical fittings are leaving Basle, and two other firms are ready to leave, owing to the exchange situation.—*The Times.*

L.E.E. Smoking Concert.—The L.E.E.O.C.A. are opening their second season with a smoking concert at the Bridge House Hotel, London Bridge, on Friday, November 25th, at 7 p.m. Mr. F. Frankling, 108, Heathwood Gardens, Charlton, S.E.7, is the honorary secretary.

Stoker Contracts.—The following are among the more important orders recently received by the Underfeed Stoker Co., Ltd.:—

St. Pancras Borough Council Power Station.—12 travelling grate stokers.
Wolverhampton Corporation Electricity Works.—Two travelling grate stokers and ash hoppers.
Salford Corporation Electricity Works and Newcastle-on-Tyne Electric Supply Co.—Ash conveyors and hoppers.
Hastings Corporation.—Two travelling grates.
Rotterdam Electricity Supply Department.—Four travelling grates.

The B.E.A.M.A. Cable Code.—The *Beama Journal* announces that the B.E.A.M.A. cable code for the electrical and allied industries is now ready, and the price is five guineas net.

Chinese Electrical Notes.—The Tsung Sing Electric Co., of Sin chen, Kiahsin, has petitioned the Ministry of Agriculture and Commerce for registration.

The Tsung Hua Electric Machine Manufacturing Co., Ltd., has been registered by the Ministry of Communications.

The Yung Yau Electric Power Co., of Ningpo, has increased its capital and notified the Ministry of Agriculture to that effect.

The Chamber of Commerce of Fau Kia Tsung, Fengtien, proposes to establish a telephone company. The Ministry of Agriculture and Commerce has been petitioned for its approval.

LIGHTING AND POWER NOTES.

Aylesbury.—Loans Sanctioned.—The Town Council has received sanction from the Electricity Commissioners to loans of £24,922 for new plant and £4,500 for mains and services.

Bedwas.—Lighting Scheme Postponed.—Doubt having been expressed as to residents being able to avail themselves of a supply of electricity on account of the present low wages and trade depression, the Urban District Council has decided to defer its electric lighting project, which was to cost £17,000, for twelve months.

Bristol.—Electricity Extensions.—The City Council has come to an agreement with the Keynsham Electric Light and Power Co. for the purchase of the company's undertaking at a cost of £4,650. It is estimated that £2,425 will be spent on alterations to mains, &c.

Works Extensions.—It is proposed to purchase 15¼ acres of land adjoining the Feeder Road Works, for extensions and other purposes, at a cost of £14,000. The matter is to be brought before the Electricity Commissioners.

Cannock.—Electricity in Bulk.—The Wolverhampton Corporation is to supply the Cannock Council with electricity in bulk, and the mains are being laid from Wolverhampton to Cannock. The Corporation will bear the cost of the main to the Cannock boundary, the Cannock authority bearing the cost of the mains to be laid in its area. A special cable is to be laid from the transformer station in Queen Street, Cannock, to the West Cannock Colliery, and it is anticipated that other collieries in the area will take supplies in the near future.

The Cannock U.D.C. has decided to apply to the Electricity Commissioners for sanction to a loan of £30,000 in connection with the scheme.

Continental.—Spain.—The Sociedad Valenciana de Electricidad has requested the Government to make it an advance of 2,500,000 pesetas for the utilisation of a waterfall supplying 4,500 h.p.—*Reuter's Trade Service* (Madrid).

Russia.—Moscow correspondence states that the constructive work on the largest central station in Russia (Kaschir) is completed, and the intention was to inaugurate it on the Octobrist anniversary. The equipment of the Yamburg electric station is also completed. Power will be taken from this station for the mechanical work on the river Zuga station.

A Moscow message says that the Ukraine Electricity Commission has approved the project for the electrification of the Lower Bug district.

Deal.—Electricity Supply.—As the Gas Company has decided not to proceed with the carrying out of its electric lighting order, the Town Council is to consider the question of carrying out a municipal scheme.

Dublin.—Reduced Charges.—The Corporation has decided to reduce the charges for power, heating, cooking, &c., by ½d. per unit, as from October 1st last. It is not proposed to make any reduction in the charges for lighting at present.

East Grinstead.—Electricity Supply.—The Urban Council has decided, in view of the Electricity Commissioners' sanction to the purchase of premises, to proceed immediately to draw up a scheme for an electricity supply, in accordance with two Provisional Orders granted to the Council.

East Ham.—Year's Working.—The accounts of the Corporation electricity undertaking (engineer: Mr. W. C. Ullman, M.I.E.E.) for the year ended March 31st last show a total revenue of £63,267, as compared with £51,813 in the preceding year. Operating expenses amounted to £58,796, as against £43,194, leaving a gross profit of £4,477 (£8,619). The net result, after payment of all capital charges, was a deficit of £7,003; in 1919-20 there was a loss of £2,340. The total number of units sold decreased from 4,537,758 to 4,477,186. The average price per unit sold was 3.35d., as against 2.71d. in the previous year.

Electricity Districts.—North-East Midlands.—With regard to the local inquiry which the Electricity Commissioners were to have held at Sheffield on the 29th inst. in connection with the Corporation's scheme for the formation of a Joint Electricity Authority for the above-named area, inasmuch as interested parties have requested further time in which to consider supplementary technical particulars, the Commissioners have postponed the inquiry.

South-West Midlands.—Sir Harry Haward, an Electricity Commissioner, opened the local inquiry, as arranged, at Birmingham on Tuesday last in connection with the area to be included in, and the schemes that have been submitted for, the reorganisation of the supply of electricity in the proposed South-West Midlands Electricity District. A report of the proceedings will appear in our next issue.

At the Worcester City Council recently Mr. W. J. Hill moved a resolution authorising him to act in negotiations with the Shropshire, Worcestershire and Staffordshire Electric Power Co., with reference to the formation of electricity districts. Negotiations had been proceeding with the company, and he thought the efforts made by the Electricity Committee had resulted in satisfactory arrangements being made between the company and the Corporation, subject to the consent of the Electricity Commissioners being given at the inquiry opened in Birmingham on November 16th. The Committee had been able to arrange for a very much extended area round the City of Worcester, an area which would cover the sites of the factories, which had already been erected. The proposed terms, moreover, included a valuable concession by the Power Co., to allow the city to lay a transmission line to link up with the Hereford undertaking.

Hemel Hempstead.—Electricity Supply.—The Town Council has decided to take steps to revoke the electric lighting order held by the Chesham Electric Light & Power Co., Ltd., under which nothing has been done. The Watford Urban Council is to be asked under what terms it will supply electricity.

Hetton (Co. Durham).—Street Lighting.—The Urban District Council has entered into a contract with the Houghton-le-Spring & District Electric Light Co. for the lighting of the existing street lamps of the Council as from September 14th, 1921, to April 14th, 1924.

Hythe (Kent).—Electricity Supply.—The Town Council has entered into an agreement with the Folkestone Electric Lighting Co. to supply electricity to the Council houses now being erected.

Lincoln.—Revision of Terms.—The Town Council has decided to seek a revision of the terms upon which electricity is supplied to two large engineering firms.

Sinking Fund Payments.—A deputation is to wait on the Electricity Commissioners with a view to obtaining authority to suspend payment for three years to the sinking funds on loans sanctioned in respect of the electricity extension scheme. If this is granted there will be an annual saving of about £4,000.

Manchester.—Strike Settled.—The dispute between the electricity works employés and the Corporation over a reduction in wages of 2d. and 1½d. per hour for skilled and unskilled workers, has been settled. The workers have agreed that the question shall be referred to the Whitley Council for the industry.

Midgley.—Electricity Supply.—The question of an electricity supply was under discussion at a recent meeting of the Urban District Council. It was stated that although the Council's consent had been given to the Yorkshire Electric Power Co.'s scheme, it was believed the company was adopting the shortest route to supply a private firm and would in consequence miss Midgley. It was decided to communicate with the company, pointing out the advantage of coming through Midgley instead of turning off at Redacre, Mytholmroyd.

Norwich.—Reduced Charges.—The Electricity Committee has decided to reduce the charges for electric lighting by 1½d. to 1¼d. per unit; and for power, the advance of 100 per cent. on the prices made during the war will be reduced to 75 per cent.

Peterborough.—Loan.—Application has been made to the Electricity Commissioners for sanction to the borrowing of £24,500 for mains, services and electricity meters.

Rochdale.—Bulk Supply.—Owing to the great increase in the demands for the supply of electricity, the Rochdale Corporation Electricity Committee is considering the re-opening of negotiations with the Lancashire Electric Power Co. for a further bulk supply.

Spalding.—Electricity Supply.—The Urban Council has rejected a proposal to apply for a Special Order for electric lighting, but has appointed a committee to consider the question of an electric lighting scheme for the town.

Walsall.—Electricity Extensions.—With a view to providing work for the unemployed, and subject to Government assistance towards the cost, the Electricity Department has received the Town Council's sanction to extend electricity mains at an estimated cost of £3,070.

Watford.—Year's Working.—The report on the year's working of the electricity undertaking shows a total revenue of £54,507 as compared with £40,000 in the previous year. The result was a net profit of £2,155.

Wexford.—Electricity Supply.—The Corporation has entered into an agreement with Mr. J. J. Stafford for the supply of electricity to the town. It is proposed to obtain a loan from the National Bank for the purchase of the necessary equipment.

Yarmouth.—Reduced Charges.—A reduction of 5 per cent., from the Christmas quarter, is to be made in the charges for electricity.

York.—Loan Sanctioned.—The Electricity Commissioners have given sanction to the borrowing of £10,000 for electricity mains, the sum to be repaid in 25 years.

TRAMWAY AND RAILWAY NOTES.

Burton-on-Trent—Inquiry Into Accident.—Major Mount, B.E., Ministry of Transport, held an inquiry into the circumstances of the tramway accident, recorded in our last issue, when a car fouled the points and overturned. One of the passengers, giving evidence, said that the front wheels appeared to take the points but the rear wheels did not. The driver applied his brakes, but the rear portion swerved, oscillated twice, and then fell over. The driver gave evidence to the same effect. The tramway engineer said that he thought the rear axle must have broken as the car was passing over the points. Upon examination a serious flaw had been found. In reply to questions the Inspector found that 18 axles had been broken during last year and 18 during the present year; renewal of axles was proceeding. The Inspector's report will be issued in due course.

Continental.—Norway.—The Western Railway from Christiania is being electrified, and experimental working between that city and Asker is to begin early in the new year. The electrical plant, which is being supplied by a syndicate headed by the firm of Per Kure, includes 22 small locomotives and 3 large ones, each of 800 h.p. There is a transformer station at Asker which will receive power from the Hakavik works at 55,000 V and reduce it to 15,000 V for the line contact conductors.

East Ham.—Year's Working.—The total revenue of the Corporation Tramway Department (engineer and manager: Mr. W. C. Ullman, M.I.E.E.) for the year ended March 31st last was £109,586, as compared with £95,235 in 1919-20. Working expenses totalled £123,912, as against £104,886, causing a gross deficit of £14,326 (£9,151). The payment of capital charges increased this loss to £33,647; the net deficit in the preceding year was £21,355. Although there was an increase in the number of car miles run from 1,386,377 to 1,440,464, the number of passengers carried declined from 19,192,452 to 17,779,901.

London.—Reduction of Fares.—The Highways Committee of the L.C.C. has had under consideration the serious diminution of traffic apparent from the weekly returns and has ascertained that the reduction has occurred only in the case of the lower fares; the number of long-distance passengers has increased. It would appear from this that passengers, objecting to the increased fares, are now walking the shorter distances. To recover this lost traffic the Committee recommends that in place of the 1d., 1½d., 2d., and 3d. fares now charged the following scale be instituted: 1d. for approximately 1.2 miles; 2d. for 2.4 miles; and 3d. for 3.6 miles. The general manager is of the opinion that the immediate result will be an increase of passengers but a reduction of receipts. Traffic will, however, build up rapidly, and the ultimate result will be a slight surplus on the year's working.

Proposed Extensions—The L.C.C. is advised by its Highways Committee to seek powers to carry out the following works: (1) The construction of a tramway from Seven Sisters Road to Stamford Hill, *via* Amhurst Park (estimated cost £74,715); (2) the construction of a tramway from Forest Hill to Bell Green, *via* Westbourne Road, Perry Vale, and Perry Rise (estimated cost £92,831); and (3) the construction of a railless trolley route from West Norwood to Lee Green (estimated cost £148,670).

Council's Approval Gained.—At Tuesday's meeting of the L.C.C., the Council approved the Highway's Committee's recommendations as to fares, and the new rates will probably be put into force on December 1st. It was also decided to apply for Parliamentary powers to carry out the extensions mentioned above.

"Underground" Scheme Amended.—The amended scheme formulated by Lord Ashfield for the extension of the "Underground" system will be considered by the Cabinet Loans Committee during this week. The original scheme was not favoured by the Committee, owing to the alleged monopolistic tendencies it revealed, and it is understood that the objectionable features have been omitted.—*Financial Times.*

Manchester.—Strike Settled.—The dispute between the Corporation and the tramway employés over the question of a reduction in wages of 2d. and 1½d. per hour for skilled and unskilled workers has been settled, the men having accepted the Corporation's offer of arbitration.

Norwich.—Year's Working.—The annual report of the Electric Tramways Co. shows a net profit for the past year of £3,933.

St. Annes-on-Sea.—Loan Sanctioned.—The Ministry of Transport has sanctioned the borrowing of £1,145 for the purchase of a tramway tower wagon.

The Tramway Industry.—The 48-hour Week.—The National Joint Industrial Council for the Tramways Industry met on November 10th at the Ministry of Labour to discuss the question of the revision of the national agreement of March, 1919, which guarantees to the workers of the country a 48-hour working week. The employers urged that the time had arrived when the agreement should be revised, but no agreement was reached, and the meeting was adjourned for the employés to consult their constituents. A conference of all the municipal tramway authorities in the kingdom represented by the Municipal Tramways Association, and of the private companies represented by the Tramways and Light Railways Association, is to be held. The Transport Workers' Union threatens to resist any attempt to enforce a longer working week.—*The Times.*

TELEGRAPH AND TELEPHONE NOTES.

Argentina.—Wireless Telegraphy.—The Chairman of the Radio Corporation of America, who has just returned from Europe, announces that as the result of negotiations with representatives of the wireless interests in England, France, and Germany it has been agreed to build one powerful station in Argentina instead of one by each country as had been originally contemplated. The chief engineer of the company is now in London discussing technical details.—*Reuter's Trade Service* (New York).

Australia. — Wireless Telegraphy. — The Amalgamated Wireless Co. is arranging to establish a direct service between Australia and England, conjointly with the Commonwealth Government, and is promising a 50 per cent. reduction on present cable charges for all classes of messages. A million capital is needed. The company has half a million and proposes to invite the Federal Government to invest the other half.—*Financial News.*

The *Daily Teleghaph* states that there is every prospect of the Government's early acceptance of the proposal, for the company's experimental stations have been in direct touch daily for three years with New York, Bordeaux, Nauen, Lyons, Hanover, New Brunswick, and Carnarvon, and also occasionally with Rome. Twenty thousand words are received from Bordeaux and transcribed weekly. The company submitted three alternative schemes. One, to finance and operate the station itself; two, to finance the station jointly with the Government; and three, to sell its patents to the Government, which would control the stations itself. The second scheme will probably be adopted, the company operating the station subject to Government supervision. The scheme provides for a central station, probably at Sydney, with sub-stations in each capital.

Continental.—Russia.—In the Government of Odessa, four receiving radio-stations have been established in the towns of Balta, Pervomaiska, Tiraspola, and Voskresensk. These stations are already communicating with Moscow.

Tests are being made in wireless telephony at the Ekaterinburg radio-station, where messages are already being received from Moscow.

A message from Moscow states that along with the work for the repairing of the Petrograd telephone station recently injured by fire, the question of constructing a new one has arisen. For preparing a scheme for a new station it is proposed to invite international competition.

Austria.—Telegraph Rate Increase.—Owing to the deficit in the Budget, it is proposed to make very large increases in the postal and telegraph and telephone rates, &c. All postal rates will be doubled and foreign letters will cost 150 per cent. more. The minimum charge for inland telegrams will be 100 crowns and 10 crowns for every additional word. City telephones with an unlimited number of calls will cost 90,000 crowns a year, and with twelve calls a day 18,000 crowns.—*Reuter* (Vienna).

Imperial Wireless.—Scheme Rejected?—The Post Office scheme for the erection of an Imperial chain of wireless telegraph stations 2,000 miles apart, to embrace the whole Empire, is reported to have collapsed because of the refusal of Mr. Winston Churchill to have anything to do with it. According to the *Westminster Gazette*, in this attitude the Secretary of State for the Colonies is supported by Sir James Stevenson, business adviser to the Colonial Office, and Dr. Eccles, the Government expert on wireless telegraphy.

At the recent Conference of Dominion Prime Ministers the official scheme was received with aloofness, and the Cabinet appointed a sub-committee, comprising Mr. Winston Churchill, Mr. Kellaway (Postmaster-General), and Sir Robert Horne (Chancellor of the Exchequer).

Mr. Churchill, who was also Chairman of the Imperial Communications Committee, definitely rejected the scheme, Sir Robert Horne, with Mr. Kellaway, agreed to go on with it very slowly—the former on the grounds of finance, the latter because, as Postmaster-General, he did not want the Post Office to lose its hold upon wireless communications. Later, when the wireless advisers were forced to admit that the Post Office proposals were out of date, the matter was finally settled. An alternative proposal has been put forward by Mr. Robert Donald, Chairman of the Empire Press Union. He advocates the formation of an All-Empire Wireless Board on the lines of the Pacific Cable Board, which has one cable owned jointly by the Governments of Great Britain, Australia, New Zealand, and Canada.

There would be this difference: the Imperial Wireless Board would be organised as a commercial company—not as a Government department. This would mean that the company would be organised as a commercial company—not as a be paid on it. This alternative plan has the support of some of the Government wireless advisers, including Sir James Stevenson and Dr. Eccles.

The Postmaster-General, backed in a lukewarm fashion by the Chancellor of the Exchequer, continued the construction of the station at Cairo; the terminal station at Leafield was planned in 1913, and, according to the *Westminster Gazette*, it was fitted with an obsolete system; the Cairo station is now being erected with identical sets. It is easy to pick up Leafield's continuous-wave signals over a large range of wavelengths. This defect is so serious that a new aerial will probably have to be designed at a cost of £50,000, the present aerial being scrapped.

The Post Office Imperial scheme involved the co-operation of the Dominions and India. Australia was the corner-stone of the scheme, but has now definitely decided to have nothing to do with it.

The Commonwealth is convinced that a high-power station can be erected in the Dominion for direct communication with Great Britain, and the Overseas Cabinet is now considering the matter.

India will consider nothing but direct communication with England; she is opposed to a re-transmitting station at Cairo.

As regards South Africa, General Smuts's Cabinet has just decided that the Union cannot participate in the British Post Office scheme, and that there will be no money to spend on wireless development for at least four years.

Japan.—New Cable.—In order to improve the connection between Japan and America, a new submarine cable is to be laid. It was first intended that it should run from Yokohama *via* the Aleutian Isles to Vancouver and Seattle, but this scheme had to be abandoned owing to the ice risks, says the *T. & T. Age*.

Telephone Service.—Submarine Cable.—The work of laying submarine telephone cables in the Tay, between Dundee and Wormit, has just been completed.

Wireless Telephony.—A wireless telephonic news service will shortly be commenced in France, says the *Daily Mail*, whereby messages from the Eiffel Tower can be intercepted by private organisations, such as banks and newspaper offices, which have receiving apparatus.

The same journal says that a commercial wireless telephone service will be inaugurated between London and Holland as soon as the Post Office authorities grant a permit. Successful tests have been carried out by the Marconi Co., and it is proposed that the service shall be by land wire to Southwold, Suffolk, thence across the North Sea by wireless to Zandvoort, and onward by land wire to Rotterdam or Amsterdam.

It is announced that the recent storm carried away the whole of the masts and aerials of the station at The Hague.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Argentina.—Buenos Aires.—January 19th, 1922. Board of Sanitary Works. Plant and accessories for a new generating station, comprising three four-cycle Diesel engines of 375 h.p., and three 3-phase alternators each of 250 kW, 2,200 V, 50 cycles.*

Australia.—Melbourne.—January 4th. Victorian Government Railways. One set pyrometer equipment (cont. 34,705), electrical equipment for cargo shifter (cont. 34,723), electric rivet heater and accessories (cont. 34,735).*

Five electric road trucks.—*Reuter's Trade Service* (Melbourne).

January 4th and 11th. Postmaster-General's Department. Telegraph instruments and telephone apparatus and material (schedule 1,718 and 604). (See this issue.)

Sydney.—April 24th, 1922. City Council. One 10,000-kW turbo-alternator and two 2,000-kW. rotary converters.—*Reuter's Trade Service* (Melbourne).

February 22nd. N.S.W. Government Railways and Tramways Department. One 5,000-kW, 50-cycle turbo-alternator, with condenser and accessories, for the Newcastle power house.*

Brisbane.—February 10th. City Electric Light Co., Ltd. Six miles of 3-core, 0.15-in., paper-insulated cable.*

Belgium.—November 28th. Municipal authorities of Saventhem. 250-h.p. gas engine and a 165-kW dynamo, with accessories. Particulars from Le Bourgmestre.

Bulgaria.—January 10th. Direction of Posts & Telephones. Sixty 50-line telephone exchanges, fifteen 100-line ditto. (November 11th.)

Chorley.—November 30th. Board of Guardians. Storage battery (128 cells—capacity 300 Ah) and booster for the Institution, Eaves Lane. (See this issue.)

Egypt.—Alexandria.—December 21st. Ports and Lighthouse Administration. Stores, including electric lamps, for six months.*

Glasgow.—November 28th. Health Department. Works (including electric lighting) in connection with the erection of doctors' and workmen's houses at Robroyston Hospital. Office of Public Works, 64, Cochrane Street, Glasgow.

November 30th. Gas Department. Two electric locomotives to haul 30 tons. (November 11th.)

Liverpool.—December 28th. West Derby Board of Guardians. Engineering work, including electric power installation, electric lift, telephone installation, boilers, stokers, &c. (See this issue.)

London.—Metropolitan Asylums Board.—November 23rd. Installation of electric lighting cables throughout the training ship *Exmouth*, off Grays, Essex. (November 4th.)

Paddington.—November 21st. G.W Railway. Three months' supply of electric wire and cables, and telegraph instruments, apparatus, and stores. (November 11th.)

Fulham.—November 12th. Electricity Department. 11,000 yd. .2 sq. in. h.p. (3,000 V) concentric, paper-insulated and lead-covered cable. (See this issue.)

Manchester. — December 2nd. Electricity Committee. Hand-operated overhead travelling cranes. Barton power station, Oldham Road, and Stuart Street sub-stations.

December 9th. Heating plant and hot-water service apparatus for offices, and self-sustaining electric hoist, Barton power station.

November 25th. Electricity Committee. Circulating-water flow and level recorders. (November 11th.)

New Zealand.—Wellington.—January 31st. Public Works Tender Board. Two sets 3-phase, 6,600-V automatic oil circuit breakers, four sets disconnector switches, and one 66,000-V air-break, lever-operated switch for main transformer switches, for Lake Coleridge power house.*

Spain.—December 30th. Application has been made to the Spanish Government for the concession for the construction and working of an electric tramway between Pontevedra and Marin. Tenders to the Direccion General de Obras Publicas, Madrid.

Tunbridge Wells.—November 21st. Electricity Supply Department. One wooden cooling tower, cast-iron circulating water piping and valves. (November 11th.)

Warrington.—November 28th. Electricity and Tramways Committee. Sub-station ironclad switchgear, high and medium pressure lead-covered cables. (See this issue.)

Wexford.—November 28th. Corporation. Overhead l.p. distribution mains, street lanterns, &c. (November 11th.)

Whitehaven.—December 1st. Electricity Supply Department. Two water-tube boilers with superheaters, economisers, pipework, &c. (November 4th.)

York.—November 21st. N.E.R. Six or twelve months' telegraph stores. (See this issue.)

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W. 1.

CLOSED.

Australia.—Melbourne.—Victorian Railways.

Lifting magnet and motor generator (£1,223).—British General Electric Co., Ltd.—*Tenders.*

Sydney.—According to *Tenders*, the City Council, in addition to accepting the tenders for the supply of consumers' meters (see Elec. Rev., November 4th, p. 610), has decided to place orders with a local manufacturing firm, the Electricity Meter Manufacturing Co., Ltd., to the extent of the company's capacity to manufacture in order to encourage local industries.

Cannock.—In connection with the scheme for the supply of electricity to the West Cannock Colliery Co., Ltd., the Council has accepted the following tenders for plant, &c.:—

Ferranti, Ltd.; General Electric Co., Ltd.; British Insulated Co.; Messrs. Reyrolle, Ltd.

Doncaster.—Town Council. Accepted:—

Low- and high-pressure cables in connection with the Arksey housing scheme (£1,181).—Enfield Edswan Co., Ltd.

London.—L.C.C. Stores and Contracts Committee. Electric goods lift at Stamford Hill Stores Depot. Holt and Willetts, £895, recommended. Fourteen tenders were received, varying from £895 to £1,550.

Semarang Harbour.—The contract for the electrification of Semarang (Java) harbour has been awarded to the Amsterdamsch Kantoor voor Indische Zaken (Akiz). The installation comprises a main transformer station, two transformer substations, and high and low pressure cables, as well as 11 transformers and 40 crane switchboxes. The Akiz represents the A.E.G. of Berlin.

Sunderland.—Electricity Committee. Accepted:—

L.p. service cables.—B.I. & H. Cables, Ltd.
Distribution board for boiler-house extension.—Switchgear & Cowans, Ltd.
Switchgear for boiler-house extension.—Reyrolle & Co., Ltd.
Meters.—Ferranti, Ltd., and Reason Manufacturing Co., Ltd.
Partial rebuilding of A.E.G. turbine.—Jas. Howden.

THE APPLICATION OF ELECTRICITY TO FARMING.

At the end of October, Mr. R. Borlase Matthews, M.I.E.E., in response to a special invitation, read a paper on "Electro-Farming" before the Royal Dutch Institution of Engineers at Nijmegen (Netherlands). Evidence of the interest displayed in that country in the electrical development of agriculture was given by the presence of the Dutch Minister of Agriculture. A number of prominent Dutch agriculturists were also present. The meeting was held at 11.15 a.m.—an hour which may seem strange to English ideas for ordinary engineering meetings, but a very practical one from a Dutch point of view, as the members come from all over the country, travelling considerable distances so as to be present, and owing to the early closing of the meeting, are enabled to return to their homes the same day.

After some words of introduction and welcome by the President of the Institution, Jr. A. J. Roelofsz, the paper was read by the author; a number of lantern slides were shown to illustrate the methods adopted by him on his experimental full-scale commercial farm at East Grinstead (Surrey).

The author contended that an extended use of electricity in farming operations was only a matter of the expiration of a comparatively brief time. Sufficient experimental and practical scale work had now been carried out in Denmark, Germany, Switzerland, Belgium, France, Italy, and Great Britain to demonstrate fully the necessity for the employment of electricity in modern agriculture, if the farms were to be really profitable concerns. Since the war, the day of the cheap labourer had passed, and hence the necessity for electro-mechanical aids. As an illustration, the author's farm of 600 acres, with such assistance, only required three horses, and no oxen. Further, the electrical equipment of a farm ensured that the various operations were more independent of the weather, since they could be carried out more quickly, when the weather suited; or in many cases they could be completed in spite of adverse weather (*e.g.*, artificial electro-haymaking, corn-sheaf drying, &c.).

The uses of electricity on farms were divided into three main heads: (*a*) power uses in the farm buildings and barns, (*b*) power uses on the fields and arable land, and (*c*) uses which were specifically electrical, such as electroculture. Illustrations were given of typical applications of electric drives, emphasis being laid on the fact that, ultimately, the ideal machine for the farmer was one that incorporated its own direct-coupled electric motor, as opposed to operation by means of a line shaft.

Various forms of portable electric motors were discussed, particularly interesting among which were larger types of 30 h.p or thereabouts, and the very substantial three-point suspension wagons employed for their support and conveyance. Electric light was referred to as advantageous to the farmer, not merely as a convenient and safe light, but also as a means of producing more eggs in winter, and bringing on young stock to earlier maturity by more winter feeding in artificial light.

Examples were cited of the electric motor driving of machinery for the food preparation for live stock, dairy machinery and general barn machinery, including pumps, &c. Similarly cases were given of applications on the land for irrigation, ploughing, cultivation and other field operations. Particular attention was drawn to the present-day development of electric ploughing, whereby, in skilled hands, 27 acres could be ploughed per day as compared with the bare acre per day of a man and team of horses. It was pointed out that on the "round-about" system, electric ploughing apparatus was now available for small fields, at a cost for power that was comparable to the big electric ploughing sets, which in turn were far cheaper to operate than steam sets.

The after-treatment of gathered crops was, of course, dealt with, as it is an important aspect of modern farming, as are likewise certain rural industries which can be conveniently operated in conjunction with a farm.

Considerable interest was evinced in the author's account of the present development of electroculture, which, he stated, had now arrived at the point where an increase of 10 per cent. in the crop could be confidently expected, at a nominal consumption, and a low outlay for wiring per acre (excepting the initial capital cost of the transforming apparatus, for which he had not yet been able to ascertain the simplest and cheapest design).

The employment of electric vehicles on farms was then touched upon, and also the author's semi-automatic system of keeping farm (or in fact any other) accounts by the aid of an electrically-operated machine—the author's contention being that detailed costings were the only true basis upon which it could be proved whether electro-farming was or was not a paying proposition; and any method which could produce these accounts without unnecessary expenditure of skill and time was certainly worthy of adoption.

The meeting concluded with a special vote of thanks, the President stating that more than the usual thanks were due by them to the author, as he had come from another country to address them on a subject concerning which he had much valuable experience of a novel nature, that would be of the utmost advantage to them.

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FORTHCOMING EVENTS.

British Electrical Development Association.—Friday, November 18th. At the Institute of Patent Agents, Staple Inn Buildings, W.C. At 8 p.m. Paper on "Salesmanship in Wiring and Installation Work," by Mr. E. H. Freeman.

Institute of Transport.—Friday, November 18th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 5 p.m. Lecture: "The Operation and Development of Urban Electric Railway Services," by Mr. J. P. Thomas.

Diesel Engine Users' Association.—Friday, November 18th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. Discussion on Mr. O. Wans's paper on "Some Recent Developments in Mechanical Injection, Oil Engines using Heavy Oils."

Institution of Mechanical Engineers.—Friday, November 18th. At the Institution, Storey's Gate, S.W. At 6 p.m. Paper on "The Machinery of Floating Docks," by Dr. E. H. Salmon.

Junior Institution of Engineers.—Friday, November 18th. At the Caxton Hall, Westminster, S.W. At 7 p.m. Annual general meeting.
Friday, November 25th. At 8 p.m. Lecturette, "Electro-Magnetic Instruments, Problems in their Design and Construction. Demonstrations," by Mr. G. F. Shooter.

Institution of Electrical Engineers.—Informal meeting, Monday, November 21st. At the Institution, Victoria Embankment. At 7 p.m. Discussion on "Hydro-electric Power," to be opened by Mr. A. J. Hainsworth.
(Liverpool Sub-Centre).—Monday, November 21st. At the University, Liverpool. At 7 p.m. Paper on "Telephone Line Work in the U.S.A.," by Mr. E. S. Byng.
(East-Midland Sub-Centre).—Tuesday, November 22nd. At the University College, Nottingham. At 6.45 p.m. Paper on "Modern Illuminating Engineering," by Mr. J. R. Milnes.
(South-Midland Centre).—Wednesday, November 23rd. At the University, Birmingham. At 7 p.m. Paper, "Some Notes on the Design of Liquid Rheostats," by Mr. W. Wilson.
(London Students' Section).—Friday, November 18th. At the Institution, Victoria Embankment. At 7 p.m. Paper on "Modern Hydro-electric Practice," by Mr. E. E. Butten
(Sheffield and District Sub-Centre).—Wednesday, November 23rd. At the Royal Victoria Hotel, Sheffield. At 7.30 p.m. Chairman's (Mr. S. E. Fedden) address and smoking concert.

Nottingham Society of Engineers.—Wednesday, November 23rd. At the Welbeck Hotel. At 8 p.m. Paper, "The Economics of Long-distance Power Transmission," by Mr. A. D. Phillips.

Royal Society of Arts.—Wednesday, November 23rd. At John Street, Adelphi, W.C. At 8 p.m. Trueman Wood lecture, "The Coming of Age of Long-distance Wireless Telegraphy and some of its Scientific Problems," by Prof. J. A. Fleming, F.R.S.

Northampton Engineering College Engineering Society.—Wednesday, November 23rd. At the Institute, St. John Street, E.C. At 5.30 p.m. Paper on "The Michel Thrust Bearing," by Mr. J. Ward.

Industrial League and Council.—Wednesday, November 23rd. At the Caxton Hall, Westminster, S.W. At 7.30 p.m. Lecture on "The Industrial Revolution in England," by Mr. H. E. Blain.

Electrical Power Engineers' Association (Manchester Section).—Thursday, November 24th. At the Association Hall, Peter Street, Manchester. At 7.30 p.m. Annual general meeting. Lecture, "Some Snapshots from my Camera," by Mr. Lunn.
(Southern Division).—At the Central Hall, Westminster, S.W. At 7 p.m. Lecture on "Some Notes on Boiler House Plant," by Mr. A. W. Bennis.

Chelmsford Engineering Society.—Thursday, November 24th. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "Gas Producers for Power and Heating," by Mr. N. E. Rambush.

Public Works, Roads, and Transport Congress and Exhibition.—November 18th to November 25th. At the Royal Agricultural Hall, Islington, N.

Edinburgh Electrical Society.—Friday, November 25th. At the Philosophical Institute. At 8 p.m. Paper on "The Manufacture of the Modern Electric Lamp," by Mr. A. S. Black.

Institution of Production Engineers.—Friday, November 25th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 7.30 p.m. Paper, "Drawings and Production," by Mr. A. F. Guyler.

King's College Engineering Society (University of London).—Friday, November 25th. At the Holborn Restaurant. Twenty-fourth annual dinner.

Physical Society of London.—Friday, November 25th. At the Imperial College of Science, South Kensington. 5-7 p.m. Discussion on Hygrometry, to be opened by Sir N. Shaw, F.R.S.

NOTES.

Appointment Vacant.—Shift engineer (£383-£433) for the Dublin Corporation. (See our advertisement columns to-day.)

The Gyroscopic Compass.—At a meeting of the Birmingham and District Electric Club on November 12th, Mr. H. T. Steventon lectured on the gyroscopic compass, which has been fully described in the ELECTRICAL REVIEW. The lecturer described the construction and action of the compass in detail, as well as the specially-designed motors used for the motive power. All modern warships were fitted with the compass, and during the last two years it had been placed on over 50 merchant ships.

Freemasonry.—The next regular meeting of the Kelvin Lodge will be held at Mark Mason's Hall on Friday, November 25th, at 4 p.m. Morning dress.

Hydro-electric Development in Baden.—According to a correspondent of the *Electrical World*, the German State of Baden has passed a law for the purpose of supplying electrical energy all over the country by means of a State-owned company. The nominal capital of this company is fixed at 30,000,000 marks, but it has in addition been authorised to raise a public loan to the amount of 500,000,000 marks which will be fully guaranteed by the State. All electric plants owned and operated by the State, such as the important Murg power works, become the property of the new company. The existing power plants have not been nearly able to supply the increasing demand for energy. At the present time 500,000 tons of coal are required annually for the generation of power and light, corresponding to an output of 500,000,000 kWh. This it is now proposed to produce by development of water power.

In the south of the country, on the line from Basle to the Lake of Constance, a number of hydro-electric power stations will be erected. One of the largest power plants will be constructed at Schwörstadt, on the German-Swiss frontier, and in this plant Switzerland will be interested financially as well as industrially, as the latter country will receive half the amount of energy produced by this station, namely, 150,000,000 kWh. The total cost of this power station is estimated at 320,000,000 marks. In order to be able fully to utilise the Rhine power works, a great storage lake will be constructed in the southern part of the Black Forest with a capacity of 72,000,000 cu. m. Several subordinate companies, all controlled by the State, will be formed to carry out this part of the work. Similar steps have been taken for the electrification of the central and northern parts of Baden. The Murg power station is to have a large storage lake, to be created by means of a dam across the surrounding valley, at a cost of 200,000,000 marks.

Electricity in Italy.—Ten months after the event, our contemporary *L'Electrotecnica* published the papers given before the yearly meeting of the Associazione Elettrotecnica Italiana, held in Rome on November 20th last. Although belated, a portion of the president's opening speech, in the light of later events both in Italy and abroad, is singularly significant. "The ruthless war," he said, "which has shaken so deeply our land, is ended, but the economic unrest remains and the preoccupation which weighs upon us for the future of our country holds our soul in suspense and anxiety. But in these days, the consecration of our victory and the sense of relief which pervades the peninsula has lifted our hearts, making us breathe a purer air and, with the reblossoming of the spirit of patriotism, permits us to hope that the pressing incubus is about to melt away, and that the calm which all long for will return, enabling us to initiate the economic renewal of our fatherland." After reference to the exertions of members of the Association in a forward direction, he continued—"in our region, electrical undertakings, far from lessening their activities during the war, rather intensified them to complete new plants in face of unnumbered difficulties, from lack of prime materials, fitful and inadequate transport, and scarcity of labour. Numerous new electrochemical works and electric foundries were also started, and among those yielding electric energy, the foundation of our industry, might be cited nine companies, among our members (Anglo-Romana, Ilva, Elettrochimica, Marchigiana, Volsinia, Lazale, Umbra, Italia Centrale, and Mediterranea), which together increased their plants by over 30,000 h.p., while 54,000 were being installed. Furthermore, new concessions and schemes, hydraulic and thermic, were being studied for the creation of about 270,000 additional h.p." In a more serious note, he continued:—"In the two years that have elapsed since the glorious victory, the difficulties which obstruct have rapidly increased: material becoming increasingly scarce, prices ever more fantastic, labour still more exigent, undisciplined and unproductive; while concern ever deepened with regard to the selling price, always insufficient to cover the cost of working, itself always rising and leaving no margin of profit, so much so, that it was impossible to undertake the construction of plant which would cost seven times that of the first establishment. These difficulties which agitated electric companies, with political and social anxieties of the moment, rendered capital perplexed, and their effects were already preoccupying banks and savings institutions. We wish for the rise of our country, that its active forces be co-ordinated, its material resources enjoyed, that industry be re-established, and for this is needed prompt and energetic work by the Government and the collaboration of all citizens to bring back the economic life as quickly as possible, to conditions of stability and equilibrium, without which no industry can develop."

X-Ray and Wireless Service Problems.—In a letter to the *Electrical World*, Mr. C. H. Mueller says the Duquesne Light Co. has supplied electric service for X-ray and radio apparatus over a period of about six years.

Owing to the operating characteristics of X-ray apparatus, many cases of flickering lights occurred when it first served such apparatus. However, these disturbances have been eliminated by the installation of 2,200/110-volt transformers and services. Such an arrangement provides the X-ray operator with ideal service, since he requires uniform voltage after he has set a machine to make an exposure. The result has been universal satisfaction.

The amateur wireless operator, however, has caused the company considerable annoyance. The transmitting outfits have been the chief trouble makers. The following cases are selected from a hundred or more investigations.

Several years ago a customer complained of flickering lights and electrical discharges similar to, but not so severe as, lightning. It was found that a wireless transmitting outfit was situated next door, and that the flickering lights and discharges occurring on the switches and chandeliers were in synchronism with messages that were being transmitted. Earthing of the wireless outfit through impedances in numerous ways was attempted, but no relief was obtained. A one-to-one transformer was also inserted in the wireless supply circuit, without effect. Finally the wireless customer was disconnected from the 110/220-volt earthed-neutral distribution bank and served from a 1-kVA, 2,200/110-volt transformer installed for his individual use. The disturbance ceased and was permanently eliminated.

In another case the wireless amateur had attached one end of his aerial to one of the poles which carried a three-wire 110/220-volt distribution circuit and four or five customers' services. The aerial crossed the services at various angles and not more than two feet distant from any of them. During rainy or damp nights, when the operator was transmitting, streams of sparks could be seen between the aerial and the service lines directly beneath. The lights on these circuits flickered, the wall switches and chandeliers buzzed and emitted sparks, the telephone service was affected, and in one case the main house fuses were blown. The same disturbances occurred, but to a less degree, on dry nights and days. The aerial was removed to a safe distance, but the trouble was not completely eliminated until a separate 2,200/110-volt transformer was installed for serving the radio operator.

A more severe case of disturbance occurred quite recently. A wireless transmitting outfit broke down the insulation on the chandelier wiring in one room of the house next door. The ceiling canopy was melted, and a hole 6 in. in diameter was burned in the ceiling. The main house fuses and tablet board were badly burned. The wireless customer compensated his neighbour for the damages, and repetition of the trouble was prevented by installing a 2,200/110-volt transformer to serve the wireless outfit.

Rheostats with the Minimum of Material.—In *La Revue Générale de l'Electricité* for October 29th is given a translation of a long article in the *E.T.Z.*, by R. Richter, describing a new method of constructing rheostats with the minimum of resistance material. Instead of putting all the wire in series, the inventor connects it in parallel and series parallel in such a way that all the resistance is constantly more or less in use, and all its radiating surface is in action. By this means a considerable economy of material is effected. The arrangements described cover polyphase as well as single-phase and d.c. apparatus.

For instance, in the case of a shunt regulator, two paths are used; the maximum resistance is obtained when the two are in series, and by means of sliding contacts they are gradually brought through series-parallel to full parallel for the minimum value, when the current in each path is half the total and the heating effect only a quarter. Each of the sliding contacts takes only half the total current, and one slider carries them both. Similarly three or four resistance elements can be employed, the ratio between the maximum and minimum resistance values being equal to the square of the number of elements, and the heating effect being reduced in an inverse ratio.

Numerous combinations are described and their characteristics fully explained. Arrangements enabling the resistance to be reduced to zero are included.

Postponement of Sinking-Fund Payments.—Bill No. 230—Local Authorities (Financial Provisions)—received the Royal Assent last week. Amongst other provisions it contains the following important clause:—

(4) Where within twelve months after the passing of this Act money is borrowed by a local authority for the purpose of the construction of new or extension or alteration of existing works forming or to form part of an undertaking of a revenue-producing character, then, notwithstanding anything to the contrary contained in any Act, it shall be lawful for the annual provision required to be made by the local authority for the repayment of the money so borrowed to be suspended while the expenditure out of that money remains unremunerative for such period and subject to such conditions as the Minister of Health or other authority by whom the borrowing is sanctioned may determine. Provided that such suspension shall not be for a longer period than five years from the commencement of the financial year next after that in which such expenditure commences to be incurred.

Other clauses enable local authorities to raise funds for current expenses by short-term loans; to vary the provisions for repayment of loans imposed by statute; and to relax the limit of borrowing powers in certain cases in order to provide employment, always subject to the approval of the Minister of Health.

Fatalities.—An inquest was held at Neath on Friday regarding the death of Charles William Jones, 33, a wireman employed by the National Oil Refineries, Skewen, who was killed at the works two days previously. Trevor Hopkins, an electrician at the works, said Jones was regulating a line of cable. He had his left hand outstretched to withdraw the vice he was using, and must have caught hold of the stay-wire with his right hand. The electric supply at this point was 250 volts alternating. The current should have been turned off before deceased commenced working, and probably deceased did not know it was on. Arthur Abrahams, the foreman electrician, said he told Jones the preceding night not to use an iron vice, and warned him and the other men to see that all switches were taken out before work was commenced. After the accident, witness found that the jaws of the vice had cut through the vulcanised rubber insulation. Witness was closely cross-questioned as to the responsibility for turning off the current, and admitted that it could only be turned off on his instructions. He was at the sub-station at the time in question, and was not told that anyone wanted the switches taken off, though he knew that Jones and others were at work on the cables. In summing-up, the Coroner remarked upon the fact that the foreman made no effort to ascertain whether the men were at work when he found the switches still on. The jury returned a verdict that death was due to an electric shock, and expressed themselves of the opinion that there was forgetfulness on the part of Foreman Abrahams in not seeing that the current was cut off prior to the men commencing work. The jury also suggested that boards should be exhibited warning the workmen to see that all switches were off before commencing work.

Radiography and Radiology.—Within the past two years university diplomas have been established in the medical application of X-rays and electricity, and a special examination, the passing of which permits the use of the letters "M.S.R.," has also been established for persons who carry out under medical direction the technical side of this work. Between these totally different examinations a great deal of confusion seems to have arisen in the public mind. A brief explanation may, therefore, be of interest, thinks the *Daily Telegraph*, which says that about three years ago the British Association for the Advancement of Radiology and Physiotherapy, a purely medical body, approached the University of Cambridge with a view to the establishment of a diploma on the same lines as the "D.P.H." (Diploma in Public Health). The university authorities instituted the Diploma in Medical Radiology and Electricity—D.M.R. and E. (Cantab.). A special course is given for this, partly at Cambridge and partly in London, under the auspices of the B.A.R.P. Anyone desiring information should write to the secretary, Education Committee, B.A.R.P., 12, Stratford Place, W. 1, or to Cambridge. A similar diploma has been established by the University of Liverpool, and others will no doubt follow. These courses and examinations are open only to medical men holding recognised qualifications, and are intended to supplement the somewhat scanty instruction in X-rays and electricity which is all that is possible in a crowded medical curriculum.

Next, the B.A.R.P. turned its attention to the question of the training and certification of technical assistants. In addition to medical knowledge such as is required in a nurse, the X-ray worker must be skilled in a technical sense—that is, he must understand the apparatus with which he has to deal. The B.A.R.P. therefore approached the Council of the Institution of Electrical Engineers and asked for co-operation. It was decided to form the "Society of Radiographers." The Council of this body, the constitution of which has been approved by the General Medical Council and the Board of Trade, consists of six medical men appointed by the B.A.R.P., six members of the I.E.E., and six elected by the general body of members. An examination is held twice yearly, and the successful candidate is entitled to use the letters "M.S.R."

The radiographer must be sharply differentiated from the radiologist. The former is the skilled technician, the latter is the medical expert who directs. Every member of the Society of Radiographers signs an undertaking that he will not examine or treat any patient except under the direction of a qualified medical man. The relationship between the two is very similar to that between the physician and the dispensing chemist.

The examinations of the Society of Radiographers are open to anyone who can show that he or she has a sound general education and has also had considerable experience of the practical side of X-ray and electrical work. No medical qualification is necessary. For candidates who have no experience, special courses of instruction are provided. Those desirous of detailed information should communicate with the secretary, the offices of this society being in the same building as those of the B.A.R.P.

An Australian Electric Furnace.—A recent issue of the *Commonwealth Engineer* contained a description of a large electric furnace installed a short time ago in the Victoria Iron Rolling Mills, West Melbourne. This is a 6-9-ton furnace, with 17 in. dia. carbon electrodes weighing 730 lb. each and having a normal current-carrying capacity of 8,670 A; the average working current is 5,000 A. The electrodes are raised or lowered by means of a 3-h.p., d.c. motor, and a 25-h.p. motor, by means of a rack and pinion gear, performs the tilting operations. Power is supplied by the Melbourne City Council at 6,000 volts (3-phase), and this is stepped down by three single-phase air-cooled transformers. A secondary series of transformers and a motor-generator provide the power for the motors. A cooling system pumps water through the roof glands and the electrode holders; all water connections and the holders are insulated from the frame of the furnace. The furnace shell is a 12 ft. dia. cylinder with a closed end, lined with refractory materials. The total weight of the furnace and charge is about 60 tons, and it will therefore be seen that the 25-h.p. motor and tilting gear is not too large. The method of employment is as follows:—After setting the hearth of the furnace, the roof is lifted on and bolted in place, the water jackets are put on, and the electrodes clamped in. About 6 cwt. of coke is spread on the bottom and the current switched on. The doors are sealed up and about 500 kW is put on the furnace for eight or nine hours. Power is then shut off for 12 hours. The next day the coke is raked out and a "heat" charged.

The Electro-Harmonic Society.—Ladies' Night.—The concert held on Friday last attained a high degree of excellence, the singing of Miss Winifred Lawson, Mr. Ivor Foster, and Miss Violet Openshaw being particularly appreciated; Mr. Jack Salisbury's violin solos were also admirably executed. Mr. J. S. Highfield presided, and there was a good attendance, though the room was not completely filled.

Proposed Institution of Chemical Engineers.—At a meeting at the Engineers' Club, Coventry Street, on November 9th, presided over by Sir Arthur Duckham, it was decided to take steps to form an Institution of Chemical Engineers. "One of the greatest things such an institute as was proposed could do," said the chairman, "would be to create a real chemical engineer."—*Morning Post.*

INSTITUTION NOTES.

Institution of Electrical Engineers.—North-Western Centre.—*Liverpool Sub-Centre.*—The following are the published arrangements for the session:—November 21st, paper on "Telephone Line Work in the U.S.A.," by Mr. E. S. Byng; December 12th, lecture on "Single and Three-phase Commutator Motors with Shunt and Series Characteristics," by Dr. S. P. Smith; January 16th, paper on "An Oscillograph Investigation of the Gulstad Relay," by Dr. S. S. Richardson; May 8th, annual general meeting and smoking concert.

Scottish Centre.—Mr. James E. Sayers presided, and introduced the new chairman, Mr. E. T. Goslin, general manager, Clyde Valley Electrical Power Co., at the opening meeting of the session, held in Glasgow on November 8th. Mr. Goslin, in his inaugural address, dealt with the subject of rates and finance as they affected the supply of electricity. Referring to the problem of unemployment and bad trade, he said that electrical undertakings could help to overcome both. Cheaper production of electricity meant cheaper rates to the consumer, which, in turn, would bring about lower manufacturing costs and improved trade, with a greater demand for labour. The co-operation of supply authorities was necessary to secure the main object of the Electricity Supply Act, 1919. Without co-operation cheap electricity could not be supplied. Bulk supplies must eventually reduce costs, and with a cheaper supply the sale of energy and the income derived would increase, and the engineer would undoubtedly benefit by the general improvement.

Informal Dinners.—Arrangements have been made for the members of the I.E.E. to dine together at the Engineers' Club, Coventry Street, W., after the ordinary meeting of the Institution to be held on December 1st. The charge per cover is 5s. 6d.

Members wishing to be present at the dinner are requested to send their names to the Secretary a day or two in advance, either in writing or by telephone. Subject to accommodation being available, additional names will also be received by the Institution attendants from members when the latter sign their names before entering the Lecture Theatre for the meeting, but it is especially preferred that members should send in their names in writing or by telephone.

Model General Conditions for Contracts.—The work of revising the I.E.E. Model General Conditions for Contracts, which began in April, 1920, was completed at the end of last session, and a new edition was published on November 1st, 1921. In addition to the members of the Committee of Revision nominated by the I.E.E., the Committee included a number of representatives of other Associations within, or closely connected with, the electrical industry, and through these representatives the Committee had the benefit of the views of the governing bodies of the various Associations interested in the Model General Conditions for Contracts. The new Conditions have been issued in such a form that they can be used as the actual contract by filling in the blank spaces.

Edinburgh Electrical Society.—On October 28th, the Society held their first "Questions and Answers" night of the session. Mr. D. S. Munro presided, and numerous questions were dealt with, chiefly relating to peculiar breakdowns in plant and installation work.

On November 11th Mr. D. Landale Frew gave a paper on "C.T.S. Cable," which was illustrated by lantern slides and numerous samples of cables and fittings. The history and manufacture of C.T.S. cables were described, and its many uses were indicated.

North-East Coast Institution of Engineers.—At a meeting of the Institution on November 11th, Mr. C. Whillis, M.I.E.E., read a paper on "The Working of a Modern Telephone System." The author considered that the manual switchboard system still had a long career in front of it; the automatic system was still in its early stages of development. The problems of design were many and difficult on account of the violently fluctuating load. Although the current in one circuit was very small, in a large exchange the discharge from the battery might at times be as high as 200 A. The author described the manual system in detail, giving particulars of protective devices, Pupin coils, &c. He also indicated some of the possibilities of the thermionic valve, and referred to the large schemes of placing trunk mains underground now being proceeded with by the G.P.O.

Greenock Association of Electrical Engineers.—On November 9th Mr. Rolling, of Glasgow, delivered the opening paper of the session before a large attendance of members. His subject, "Automatic Electric Control Gear with Special Application to Shipyard Equipment," was well illustrated by lantern slides and diagrams. Mr. Rolling's *pièce de résistance* was a self-resetting breaker, which discriminated between temporary and other short circuits.

Belfast Association of Engineers.—At the meeting held yesterday evening, a paper on "Electric Industrial Illumination" was read by Mr. George Herbert.

King's College Engineering Society.—The 24th annual dinner of the Society is to be held at the Holborn Restaurant on November 25th. Mr. J. S. Highfield, President, I.E.E., will preside, and the principal guests will be Mr. W. B. Worthington, B.Sc., President, Inst.C.E., and Sir R. A. Hadfield, Bart., F.R.S.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

It is announced that having in view his long association with electrical progress in this country, and his great services to the Institution in connection with the obtaining of a Royal Charter and Royal Patronage, when his enthusiastic help, by counsel, advice and active co-operation with the Charter Committee proved invaluable, the Council of the Institution of Electrical Engineers has elected as an Honorary Member LORD SOUTHBOROUGH, P.C., G.C.M.G., &c.

Lord Southborough, who is a Privy Councillor, and better known to electrical men under his older title of Sir Francis Hopwood, has had a distinguished career in the Board of Trade and other Government Departments, and in the eighties was closely associated as Assistant Solicitor to the Board of Trade with electrical legislation. From 1901 to 1907 he was Permanent Secretary to the Board of Trade, and subsequently Permanent Under-Secretary of State for the Colonies, and just before, and during part of, the war Civil Lord of the Admiralty.

As British delegate to the International Railway Congresses of 1895 and 1900, as Vice-Chairman of the Development Commission, 1910, and as member of the Royal Commission on London Traffic, he has been closely associated with the problem of railway electrification, and he is also a member of the board of directors of the London Underground Railways.

He is on the Board of Control of the National Physical Laboratory, where he has actively supported research and experimental investigation of electrical matters.

Mr. F. GEERE HOWARD, A.M.I.C.E., electrical engineer, of 59, Berners Street, W.1, has been elected Mayor of Hampstead.

Councillor J. BELL, is the new Mayor of West Bromwich. His chief work on the Council has been done as chairman of the Electricity Committee.

Councillor JAMES THOMPSON, who has been re-elected Mayor of Wolverhampton, is chairman of the Corporation Electricity Committee.

Councillor H. K. BEALE has been re-elected chairman of the Birmingham Electricity Supply Committee.

Councillor F. SMITH succeeds Councillor Lee as chairman of the Birmingham Tramways Committee, and the latter is the new chairman of the Public Works Committee.

The Swedish Academy of Sciences has awarded the Nobel Prize for Chemistry for 1920 to Prof. WALTER NERNST, of Berlin, the inventor of the Nernst electric lamp.

Sir A. K. BUTTERWORTH is retiring from the post of general manager of the North-Eastern Railway at the end of the year, and Mr. R. L. WEDGWOOD, the present deputy general manager, takes up his position as from January 1st.

Mr. R. L. MCCULLOCH, who recently went to Australia, has been appointed general manager to the City of Hobart (Tasmania) Municipal Electric Tramways at £750 per annum salary.

Mr. F. H. MANN has joined Messrs. Moffett & Rosher, consulting engineers, of Birmingham, as a partner, he having been formerly associated with the firm as assistant engineer. The style of the firm will now be Moffett, Rosher & Mann. At the conclusion of the war, Mr. Mann was a lieutenant (E.) in the battle cruiser H.M.A.S. *Australia*, being in charge of the electrical generating plant and equipment. Early in 1919 he was engaged upon the extensions to the Grimsby Corporation electricity works, and was occupied on this work until he resigned to rejoin his old firm.

On Saturday last the staff of the South Shields Electricity Department presented Mr. E. MOXON, the borough electrical engineer (who is leaving to take up a similar position at Southport), with a silver tea and coffee service and salver. The presentation was made by Ald. J. W. Henderson, chairman of the Electricity Committee.

Obituary.—SIR DOUGLAS FOX.—We regret to state that Sir Charles Douglas Fox, the well-known engineer, passed away on Sunday last in London after a few hours' illness, in his 82nd year. Sir Douglas was the eldest son of the late Sir Charles Fox, who was the constructor of the 1851 Exhibition building which was afterwards re-erected as the Crystal Palace. He joined his father as an articled pupil in 1857, and in 1862, after practical experience, he became a partner in the firm. When Sir Charles died, Douglas and his brother Francis succeeded to the business, which is now so well known amongst engineers as Sir Douglas Fox & Partners. This firm was responsible for numerous large railway undertakings, among which the Liverpool Overhead Electric Railway and the Mersey electric tunnel line, also two London tube systems, the Great Northern and City, and the Charing Cross, Euston and Hampstead railway, are of direct interest in these pages. In their other consulting engineering operations may be mentioned their part in connection with the North Wales hydro-electric

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SIR DOUGLAS FOX.

power scheme, the great piece of bridge work across the Victoria Falls, the preparation of new plans for the Channel Tunnel, and many railway and other undertakings in different parts of the Empire and in foreign countries. Sir Douglas Fox had been a member of the Institution of Civil Engineers since 1866, and he was its president in 1899 to 1900. He was prominently connected with the British Engineering Standards Association from its commencement. Sir Douglas received the honour of knighthood in 1886, as recognition of his work, in association with the late Sir James Mirrlees, as engineer of the Mersey Tunnel. He has left one son, Mr. Francis Douglas Fox (a partner in the firm mentioned) and four daughters. The funeral service was to be held yesterday at Sevenoaks.

MR. E. WINDSOR RICHARDS.—We regret to record the death of Mr. E. Windsor Richards, the well-known ironmaster, which occurred last Saturday, at the age of 90 years. The deceased gentleman was a past president of the Iron and Steel Institute, of the Institution of Civil Engineers, and of the Cleveland Institution of Engineers.

Mr. W. H. BOOTH.—We deeply regret to learn that Mr. W. H. Booth died at Worthing on November 12th. Mr. Booth was for over 30 years an esteemed contributor to our columns, and a valued friend. In our next issue we shall give an outline of his career.

Will.—The late Sir H. B. ROWELL, chairman and managing director of Hawthorn, Leslie & Co., Ltd., left £97,734 gross and £89,072 net.

NEW COMPANIES REGISTERED.

Morgan's (Birmingham) Electric Motors, Ltd. (177,753).—Private company. Registered November 10th. Capital, £3,000 in £1 shares. To carry on the business of electrical, motor and mechanical engineers, manufacturers of and dealers in electrical apparatus, &c. The permanent directors are: T. J. Bowater, 245, Franklin Road, King's Norton, Birmingham (director, Birmingham Power Transmission, Ltd.), chairman; S. C. Bruton, Ellamead, Lordswood Road, Harborne, Birmingham (director, Birmingham Power Transmission, Ltd.); S. B. Morgan, 281, Maryvale Road, Bourneville, Birmingham. Qualification, 100 shares. Secretary: S. C. Bruton. Registered office: 20, Regent's Place, Birmingham.

Car Ignition and Lighting Co., Ltd. (177,655).—Private company. Registered November 4th. Capital, £1,500 in £1 shares. To take over the business of manufacturers and repairers of and dealers in motor car lighting and ignition apparatus carried on by A. H. Moncrieff and W. J. E. Beere at 26, Page Street, Westminster, as the "Car Ignition and Lighting Co." The first directors are: A. H. Moncrieff, 197, Anerley Road, S.E.20; W. J. E. Beere, Kenton Court, Sunbury-on-Thames; O. Fayle, Sandford Lodge, Ranelagh, Dublin. Qualification, £100. Secretary: O. Fayle. Registered office: 26, Page Street, Westminster.

Wintersgill & Worth, Ltd. (177,727).—Private company. Registered November 8th. Capital, £500 in £1 shares. To carry on the business of mechanical, electrical, motor and petrol engine engineers, manufacturers and suppliers of electric fittings, tool makers, brass founders, metal workers, metallurgists, &c. The first directors are: G. Wintersgill, 18, Devonshire Road, Middlesbrough; W. M. Worth, 18, Eaton Road, Stockton-on-Tees. Qualification, 50 shares. Solicitor: A. H. Parkin, Stockton-on-Tees.

Stentaphone Motor Accessories (1921), Ltd. (177,431).—Private company. Registered October 22nd. Capital, £75,000 in £1 shares. To take over the business (1) of Stentaphone (Motor Accessories), Ltd., carried on at Alcester Road, Moseley, and (2) of William Sames, Ltd., carried on at Camp Hill, Birmingham, and to carry on the business of manufacturers of motor accessories, magnetos for use with internal combustion engines, manufacturers of dynamos for lighting, power, and other purposes, manufacturers of motor cars and other vehicles, &c. The subscribers (each with one share) are: A. H. Treloggan, 310, Alcester Road, Moseley, Birmingham, manufacturer; W. L. Sames, 50, Reddings Road, Moseley, Birmingham, manufacturer. The first directors are: A. H. Treloggan (chairman), W. L. Sames, Sarah M. A. Treloggan, E. Treloggan, W. Sames, and H. W. Sames. Registered office: 21, Ombersley Road, Balsall Heath, Birmingham.

Union Electric Welding Co. (Egypt), Ltd. (177,649).—Private company. Registered November 3rd. Capital, £10,000 in £1 shares. To carry on the business of electrical, blow-pipe, and other welders and solderers, shipbuilders and repairers, &c. The subscribers (each with one share) are: E. S. O'Reilly, 52, Bishopsgate, E.C.2, solicitor's managing clerk; H. J. T. Mitchell, 52, Bishopsgate, E.C.2, cashier. L. Savon & Co., Ltd., are the first managers. Solicitors: Maxwell & Co., 52, Bishopsgate, E.C.2.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Oswestry Electric Lighting and Power Co., Ltd.—Satisfaction to the extent of £500 on August 16th and £200 on October 11th, 1921, of debentures dated January 6th, 1912, and March 2nd, 1915, securing £1,300.

Armature Repairing and Supply Co., Ltd.—Particulars of £4,000 debentures authorised November 1st, 1921, present issue £1,400; charged on the company's undertaking and property, present and future, including uncalled capital.

Radio Communication Co., Ltd.—Particulars of £23,000 debentures, authorised October 24th, 1921; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

Turner Atherton & Co., Ltd. (66,901).—Return dated September 8th, 1921. Capital, £175,000 in £1 shares (87,500 ordinary and 87,500 preference). 61,842 ordinary and 73,811 preference shares taken up. £26,487 paid. £109,166 considered as paid. Mortgages and charges, nil.

W. Sisson & Co., Ltd. (82,295).—Return dated October 21st, 1921. Capital, £50,000 in £1 shares (5,000 preference, 38,000 ordinary, and 7,000 deferred). 4,375 preference, 31,711 ordinary, and 7,000 deferred shares taken up. £28,686 paid. £14,400 considered as paid. Mortgages and charges, debit bank balance £7,776 13s. 2d. (limit £15,000).

Everett Edgcumbe & Co., Ltd. (84,764).—Return dated July 11th, 1921. Capital, £45,000 in £1 shares (5,000 6 per cent. cumulative preference, 39,997 ordinary, and 3 "A"). 3,300 preference, 29,733 ordinary, and 3 "A" shares taken up. £12,520 paid. £17,516 considered as paid. Mortgages and charges, nil.

Rural Electricity Supply Co., Ltd. (107,281).—Return dated September 15th, 1921. Capital, £10,000 in 9,500 preferred shares of £1 each and 10,000 deferred shares of 1s. each. 5,512 preferred and 5,713 deferred shares taken up. £3,269 9s. 3d. paid (being £1 per share on 2,871 preferred and 1s. on 5,713 deferred shares) and including £112 16s. 3d. paid on 205 shares forfeited. £2,641 considered as paid. Mortgages and charges, nil.

W. R. Sykes Interlocking Signal Co., Ltd. (93,078).—Return dated October 19th, 1921. Capital, £50,000 in 87,500 "A" and 12,500 "B" shares of 10s. each. 42,297 "A" and 12,500 "B" shares taken up. 3s. 9d. per share called up on 42,297 "A" shares. 10s. per share considered as paid on 12,500 "B" and 5s. per share on 42,297 "A" shares. Mortgages and charges, £14,721.

Newtons, Ltd. (48,936).—Return dated January 14th (filed June 17th), 1921. Capital, £40,000 in £10 shares. 3,265 shares taken up. £18,650 paid. £14,000 considered as paid. Mortgages and charges, nil.

South Metropolitan Electric Light and Power Co., Ltd. (47,875).—Return dated March 9th (filed June 8th), 1921. Capital, £500,000 in 250,000 ordinary, 150,000 7 per cent. cumulative first preference, and 100,000 6 per cent. cumulative second preference shares of £1 each. 165,000 ordinary, 143,468 first preference, and 96,366 second preference shares taken up. £1 per share called up on 162,560 ordinary, 138,100 first preference, and 96,366 second preference shares. £396,966 paid. £7,868 considered as paid on the remainder. Mortgages and charges, £374,090.

Brookmill Motor & Engineering Co., Ltd.—Debenture dated October 17th, 1921, to secure £250, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: F. F. C. Webb, 12, Abchurch Lane, E.C.

Oswestry Electric Lighting & Power Co., Ltd.—Particulars of £1,500 debentures authorised October 11th, 1921; present issue £800, charged on company's property, present and future, including uncalled capital, but excluding book debts, due to the company for current supplied, and subject to any legal priority attached to the security already given to London, County, Westminster & Parr's Bank.

Swift Electrical, Ltd.—Debenture dated October 18th, 1921, to secure £800, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: J. H. Butler, 94, Woodland Gardens, N.10.

CITY NOTES.

Barcelona Traction, Light & Power Co.

The financial papers have published particulars of the situation which has arisen, necessitating the calling together of the holders of the 5½ per cent. first mortgage bonds and income bonds, in London on November 25th, for the purpose primarily of modifying the rate of interest payable on the first mortgage bonds. According to the *Financial Times*, the committee for the bondholders states that at the commencement of the European war, conditions were such that it was found impossible to pay in cash any of the interest on the First Mortgage bonds or on the Prior Lien "B" bonds, and provision was made for satisfying such interest in short-term notes, which, by the arrangement made in 1918, were subsequently converted into Income bonds.

In 1918 the hydro-electric installation of the Ebro Irrigation and Power Co.—which in 1915 was in an unfinished state—was completed and nearly the entire output was sold, and work on the new installation at Camarasa, which had been undertaken to meet the demand for additional power, was well advanced. The industral conditions in Barcelona at the conclusion of the war were so encouraging, and the growth of business so satisfactory, that there was every reason to assume that the power available from the first two units of Camarasa would be rapidly sold, and the revenue from operation considerably increased. The directors' and bondholders' committee, therefore, felt that they were justified in recommending that at least 2 per cent. interest should be paid in cash on the First Mortgage bonds, to be increased to 4 per cent. as from the 1st June, 1921. This recommendation was approved by bondholders in December, 1918, and from then to the present time interest at 2 per cent. per annum has been regularly paid, the revenue not having justified a higher rate being paid. By the arrangement the minimum rate was to be increased to 4 per cent. per annum as from 1st June, 1921, but the committee regrets to inform bondholders that owing to the change in world conditions since 1918, from those of a trade boom to those of world-wide depression, with the consequent disorganisation in exchange, the revenue of the company will not permit of the interest being raised to 4 per cent., and bondholders will be asked at the forthcoming meeting to agree that the minimum rate should continue at 2 per cent. per annum.

The directors' committee advise bondholders to agree to the proposals. These, shortly, are that the minimum rate of interest should remain at 2 per cent., but that the maximum amount payable should be raised from 5½ to 6 per cent.

Monte Video Telephone Co., Ltd.

At the annual meeting held on November 10th, in London, Viscount St. Davids stated that during the summer he had been out in the River Plate, and he went to Monte Video and made a very careful inspection of the company's property. He further inquired into the whole circumstances arising out of the present position of affairs. They did not boast that they gave a perfect telephone service; they gave what was a good service in the conditions under which they were permitted to work. The speaker, according to a report in the financial Press, said that the company had been at a disadvantage for a good many years in that they had not got a concession that would enable them to do the work properly. That had been the outstanding position for a long time past, but the Government had lately made up its mind that it wanted a system of its own. Recently the Government had made a contract with the Western Electric Co. to put in a system, but the contract had been made subject to ratification by the Legislature, and, as far as he knew, that ratification had not yet been given. The contract was also made subject to the capital being raised, and when he was over there there seemed to be no prospect at all that the Government would agree to the terms, as the conditions that the Americans were seeking to impose were undoubtedly somewhat onerous. So far, nothing at all had been done.

The Zurich Bank for Electrical Undertakings.

The probability of a further reconstruction of the Bank fur Elektrische Unternehmungen, of Zurich was foreshadowed at the annual meeting held in that city on October 31st, when it was decided to carry forward the balance of 112,000 fr. Supplementing the report for the year ended June 30th, 1921, the management stated that since the latter date the bank's credit in marks, as a result of sales of marks and the exercise of the right of subscription to new shares, had receded from 75,000,000 to 27,000,000 marks, of which a sum of 6,500,000 marks was already engaged for impending capital increases of German undertakings. As compared with the end of June, the assets of the bank at present quotations and rates of exchange showed a further depreciation of 3,000,000 fr. The receipts from dividends and interest were being further prejudiced by the constant fall in exchange, but if the

latter did not become still worse, the surplus from the ordinary receipts for 1921-22 would be about sufficient to cover the legal instalment of the redemption of the uncovered differences in exchange. During the discussion, Herr Wilchek, president of the Bank fur Handel und Industrie, stated that the Zurich undertaking ought to undergo a fresh reorganisation, as it was necessary to renounce the hope of any improvement in exchange. The uncovered exchange differences of 46,000,000 fr. must completely disappear from the balance sheet, the ordinary share capital be extinguished, and the priority capital be reduced by about 50 per cent. In reply, Dr. Frey, president of the bank, expressed the opinion that all hope of an improvement in exchange should not be abandoned. Germany, which introduced the gold standard in 1871, had not only the legal but also the moral obligation to restore her currency to the former basis. That would, of course, occupy many years, and the bank would have to take into consideration the question of a further re-organisation. The time for that must be left to the directors, who would produce their proposals as soon as the exchange situation had cleared somewhat, perhaps after the Washington Conference.

French Companies.

The directors of the *Compagnie Générale d'Electricité* recommend a dividend at the rate of 60 fr. per share for 1920-1921, as in the previous year.

The *Société Industrielle des Telephones*, which distributed a dividend at the rate of 35 fr. per share out of net profits amounting to 4,119,000 fr. in 1919-1920, is reported to have earned net profits of 7,014,000 fr. in 1920-1921, for which the rate of dividend has not yet been fixed.

The *Société des Accumulateurs Electriques* (*Dinin*) reports profits of 592,000 fr. for 1920-1921, exclusive of any provision for depreciation, as contrasted with 1,676,000 fr. in the preceding year. As the statutory rate of interest of 6 per cent. has already been paid on the shares, no further distribution is in contemplation, the balance of 246,000 fr. being carried forward. The report states that improvements had been made in the accumulators, which permitted of the batteries being sent away in a charged condition without acid, the latter being added when the batteries were required for use.

An extraordinary meeting of the *Constructions Electriques Lyon-Dauphiné* held on October 15th sanctioned the increase of the company's capital from 5,000,000 to 10,000,000 fr., by the issue of 8,000 500-fr. shares, with a premium of 25 fr.

An extraordinary meeting of the *Forces Motrices de la Rochette et de Quincampoix* has approved the raising of this company's capital from 1,000,000 to 3,000,000 fr., the increase to be expended as follows:—400,000 fr. for the assets of the Société Sarthoise d'Electricité; 500,000 fr. for those of the Société d'Electricité de la Sarthe; 1,000,000 fr. for the assets of the Omnium Francaise d'Electricité; and 100,000 fr. for those of the Compagnie Générale des Ilots Electriques. The Forces Motrices Co. has now changed its name to Energie Electrique Maine-Anjou.

Electric Construction Co., Ltd.—The directors have declared interim dividends at the rate of 7 per cent. per annum on the preference and 6 per cent. per annum on the ordinary shares, both less tax, in respect of the profits for the year ending in next March.

Companies to be Struck off the Register.—The following are to be struck off the register within three months unless cause is shown to the contrary:—

Blackpool Electric Tramways (South), Ltd.
British Lamp Manufacturers, Ltd.
Electric Generating Stations, Ltd.
Electromotor Equipment Co., Ltd.
Simplex Insulators (Bourke's Patent), Ltd.

Manaos Tramways & Light Co.—The financial Press states that the ordinary meeting of this company will be held at 9, Cloak Lane, E.C.4, on Monday next, but in consequence of the appointment of the receiver and manager there are no accounts available for presentation to the shareholders.

United Electric Tramways Co. of Caracas, Ltd.—A dividend of 8 per cent. less tax for the year is announced in the *Financier*. £14,852 is carried forward subject to E.P.D. and Corporation profits tax.

American Telegraph & Telephone Co.—According to the *Financial News*, the $50,000,000 bond issue of this company has been five times over-subscribed, this testifying to the abundance of money seeking investment.

Stock Exchange Notice.—The undermentioned have been ordered to be officially quoted:—

United River Plate Telephone Co.—108,000 ordinary shares of £5 each, fully paid (Nos. 324,001 to 432,000).

Indian Electric Supply and Traction Co., Ltd.—An interim dividend of 3 per cent. on the ordinary shares has been declared.

Chloride Electrical Storage Co., Ltd.—A dividend of 5 per cent. actual on the ordinary shares, tax free, has been declared.

British Thomson-Houston Co., Ltd.—The "Times" City Editor stated in Wednesday's issue that underwriting arrangements were being made on that day for the issue of £1,500,000 7 per cent. mortgage debenture stock of this company at the price of 92½. The prospectus will probably be published next week. The issue, which forms part of a total of £3,000,000, will be repayable by May 1st, 1962, by the operation of a sinking fund beginning next year.

North Melbourne Electric Tramways & Lighting Co.—The financial Press states that the gross receipts for the year ended September, 1920, were £53,683, against £45,764 in the previous year, and the net revenue was £13,232, against £11,228.

STOCKS AND SHARES.

Tuesday Evening.

The strength of most Stock Exchange markets continues unabated. There is plenty of money available for investment in gilt-edged issues. One after another, substantial lines of stock are offered to the public, and these find, as a rule, a home readily enough. At all events, there is no difficulty in getting them underwritten, and this is what the promoting-houses desire first of all. The railway markets are not exciting. Undergrounds have given way in consequence of the proposal of the L.C.C. to re-institute penny fares on the trams. It is thought that this step may have to be followed by the L.G.O.C. on those routes over which there is tram competition. Coming at a time when the company is contemplating big extensions and capital expenditure, any prospect of diminution of fares puts a little anxiety into the minds of stockholders. Therefore Underground Incomes are down to 66½, and the £10 shares to 30s. Metropolitan Consolidated is ¼ down, but Districts gained the same fraction.

The international event of the week has been the proposal of the United States to Great Britain and Japan, that the three countries should agree upon a battleship-building holiday for ten years. On the strength of this, armament shares promptly dropped. Vickers were 12s. and gave way to 10s., Armstrongs following less rapidly, but in the same direction. There has been a trifling rally from the worst, on the assumption that, in any case, it will be months before anything definite is done. The bold suggestion would be gladly welcomed if it were felt to be practicable in the light of the insular position of this country, the present unemployment difficulties, and the steady resuscitation of German industry. There is plenty of material upon which the theorists, statesmen, and others can sharpen their wits. Apart from the heaviness in Armament shares, the mere prospect of freedom for ten years from excessive naval charges has helped the strength of the tone in gilt-edged stocks and shares.

The River Plate Electricity Co. has sent out a letter to the holders of the 5 per cent. debenture stock, in which the secretary says:—

"We shall be glad if you will present the certificate for debenture stock held by you to be exchanged for a new certificate to bear reference to the Deed of 22nd June, 1914, whereby there was secured to the Trustees for the benefit of the stockholders a fixed mortgage charge upon certain heritable property of the company at La Plata and a floating charge upon its undertaking and all other assets."

This has aroused comment from the fact of the matter having been apparently overlooked for no less than seven years, and some stockholders are inclined to wonder why the step now proposed was not taken previously.

Matters in Mexico seemed to have marched once more to their favourite deadlock. President Obregon cannot arrive at a satisfactory basis for agreement with the United States Financial Commission with regard to a formula agreeable to both, which shall enable recognition of Mexico by America, and the subsequent issue of a loan from the latter to the former. Efforts are still being made, we understand, to bring about a frame of mind compatible with the dignity of both parties, but sufficiently complacent to enable mutual agreement to be reached. Meanwhile, as is natural, prices of Mexican issues, Government, utility, mining and railway, continue to languish, and this is the reason why prices of the Mexican tramway and lighting companies have been depressed during the past few weeks. Mexico Tramways First mortgage bonds are 4 points lower.

Charing Cross Ordinary at 4½ are ¼ up, and St. James's at 6¾ are similarly better. The electric lighting market is good throughout. County of London new debenture stock has risen to 8 premium. Metropolitan Electric Extension debenture is better at 104. South Metropolitan preference hardened to 16s. 3d. The improvement has extended to the manufacturing group.

General Electrics at 17s. 6d. are 9d. higher, and rises have occurred in Electric Constructions, English Electric ordinary and preference, and Siemens. Recent uneasiness has been replaced by a better tone, and prices had slumped to such

levels as tempted speculative purchasers to take a hand. In addition to this, there came a little buying into the market on behalf of people who had bought shares at substantially higher figures, and, who were content to average at the present levels.

Cable manufacturing shares are also better. Callenders improved to 27s. 6d., and the company's 7½ per cent. "B" preference shares are higher at £1. Henleys have risen to 29s. 3d., the preference to 3 5/16. Telegraph Constructions are unchanged at 21½. Amongst other miscellaneous issues may be mentioned India-Rubber shares, which, nominally 19s. 9d., changed hands the other day at 11s. 9d.

Shanghai Electric ordinary at 15 are 10s. higher. Anglo-Argentine Tramways 5 per cent. debenture stock at 64½ is 1½ up. Metropolitan Electric 4½ per cent. irredeemable debenture advanced to 57¼. Manaos Tramways first debenture at 49½ is 8 points down, which is not very surprising, considering the financial condition of the company.

Marconi's eased off to 32s. 6d., and other wireless shares are dull. Cable stocks are scarcely so steady, there being small falls in Eastern Telegraph ordinary and Anglo-American preferred. Chili Telephones shed ¼; United River Plates, however, hardened to 5½.

Rubber shares are again better. The price of the material is within a few farthings of 1s. a lb., and, with very little stock about, substantial buying orders from the North and Midlands caused material recoveries in share prices. The market continues firm, though it is noticeable that upon any profit-taking the list easily yields ground. Business in the rubber and other industrial sections is better than it was at the beginning of the month. The reduction in the Bank Rate is obviously bringing a good deal of new capital into all the markets.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1919.	Dividend. 1920.	Price Nov. 15, 1921.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	11	6½	—	£9 18 0
Charing Cross Ordinary	7	8	4½	—	8 17 10
do. do. do. 4½ Pref.	4½	4½	2½	—	7 4 4
Chelsea	4	6	3½	—	9 4 8
City of London	18	14	28 9	—	10 9 6
do. do. 6 per cent. Pref.	6	6	17/6	—	6 17 2
County of London	8	8	8½	—	9 10 4
do. do. 5 per cent. Pref.	6	6	7½	—	7 10 0
Kensington Ordinary	7	9	4½		9 14 6
London Electric	2½	2½	1	—	7 10 0
do. do. 6 per cent. Pref.	6	6	3	—	10 0 0
Metropolitan	6	7	3½	—	9 6 8
do. 4½ per cent. Pref.	4½	4½	2½	—	7 13 2
St. James' and Pall Mall	12	12	6½	+ ½	8 17 10
South London	6	7	2½	—	10 13 2
South Metropolitan Pref.	7	7	16/9	+6d.	8 12 4
Westminster Ordinary	10	10	5½	—	8 18 10
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	82½	—1½	7 5 7
do. Def.	1¼	1¼	17-	—	8 16 6
Chile Te'ephone	6	6	5½	— ½	5 17 3
Cuba Sub. Ord.	7	7	7	—	10 0 0
Eastern Extension	10	10	16½	—	6 1 0
Eastern Tel. Ord.	10	10	168½	—1	6 2 4
Globe Tel. and T. Ord.	10	10	16½	—	6 1 0
do. do. Pref.	6	6	9½	—	6 9 9
Great Northern Tel.	22	24	25	+ ½	9 12 0
Indo-European	10	10	30	—	8 6 8
Marconi	25	15	1½	— 1/8	9 4 8
Oriental Telephone Ord.	12	12	2	—	*6 0 0
United R. Plate Tel.	8	8	5½	+ ¼	*7 2 3
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	16½	—	*6 1 0
Home Rails.					
Central London Ord. Assented	4	4	49½	—	8 1 8
Metropolitan	1½	1½	23	— ½	6 10 5
do. District	Nil	Nil	16½	+ ½	Nil
Underground Electric Ordinary	Nil	Nil	1½	— ½	Nil
do. do. "A"	Nil	Nil	5/-	—	Nil
do. do. Income	4	2	66½	— 2	*4 10 4
Foreign Trams, &c.					
Anglo-Arg. Trams. First Pref.	5½	12½	25	—	10 9 6
do. do. 2nd Pref.	Nil	5½	2½	—	10 4 8
do. do. 5 per cent. Deb.	5	5	64½	+1½	7 15 0
Brazil Tractions	Nil	Nil	29	—1	Nil
British Columbia Elec. Rly. Pfce.	6	6	58	—1	8 12 4
do. do. Preferred	5	93/-	51	—	*9 5 0
do. do. Deferred	2	124/-	53	+1	*11 13 10
do. do. Deb.	4½	4½	58½	—	*7 6 4
Mexico Trams. 5 per cent. Bonds	Nil	Nil	52	—4	—
do. do. 6 per cent. Bonds	Nil	Nil	26	—	Nil
Mexican Light Common	Nil	Nil	10	—	Nil
do. Pref.	Nil	Nil	25	—	Nil
do. 1st Bonds	Nil	5	52½	—	9 10 6
Manufacturing Companies.					
Babcock & Wilcox	15	15	2	—	6 18 6
British Aluminium Ord.	10	10	18/9	—	—
British Insulated Cal.	15	15	1½	—	10 0 0
Callenders	15	15	1½	+ ⅛	10 18 2
,, 6½ Pref.	6½	6½	18/9	—	6 18 8
Crompton Ord.	20	10	14/6	—	13 15 10
Edison-Swan	10	—	5/-	—	—
do. do. 5 per cent. Deb.	5	5	67	1	7 9 1
Electric Construction	10	10	17/6	+9d.	11 8 6
English Electric	8	8	10/9	+3/3	14 18 0
do. Pref.	6	—	12/6	+ ⅛	9 12 0
Gen. Elec. Pref.	6½	6½	16/6	+6d.	7 17 6
do. Ord.	10	10	17/6	+9d.	11 8 6
Henley	15	15	29/3	+1/9	10 5 2
do. 4½ Pref.	4½	4½	3	+ ⅛	6 15 10
India-Rubber	10	—	11/-	—	—
Met.-Vickers Pref.	8	8	1½	—	8 16 8
Siemens Ord.	10	10	21½	+9d.	*9 10 10
Telegraph Con.	20	20	21½	—	*5 11 9

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, November 16th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic per lb.	9d.	1½d. inc.
a Ammoniac Sal per ton	£65	..
a Ammonia, Muriate (large crystal) ,,	£58	..
a Bisulphide of Carbon ,,	..	..
a Borax ,,	£61	..
a Copper Sulphate ,,	£30	..
a Potash, Chlorate per lb.	6½d.	½d. inc.
a ,, Perchlorate ,,	6d.	..
a Shellac per cwt.	£17 10s.	£1 inc.
a Sulphur, Sublimed Flowers ,,	£15	£1 dec.
a ,, Lump ,,	£14	£1 dec.
a Soda, Chlorate per lb.	3½d.	..
a ,, Crystals per ton	£7	..
a Sodium Bichromate, casks per lb.	6½d.	1d. dec.
METALS, &c.		
b Babbitt's Metal Ingots per ton	£90 to £275	..
c Brass (rolled metal 9" to 12" basis) per lb.	10½d.	..
c ,, Tubes (solid drawn) ,,	1/0½ to 1/0½	..
c ,, Wire, basis ,,	11½d.	..
c Copper Tubes (solid drawn) ,,	1/2½	..
c ,, Bars (best selected) per ton	£101	..
c ,, Sheet ,,	£101	..
c ,, Rod ,,	£101	..
d ,, (Electrolytic) Bars ,,	£76 10s.	£1 10s. inc.
d ,, ,, Sheets ,,	£145 10s.	..
d ,, ,, Wire Rods ,,	£92 10s.	£1 10s. inc.
d ,, ,, H.C. Wire per lb.	11½d.	½d. inc.
f Ebonite Rod ,,	3/6	..
f ,, Sheet ,,	3/-	..
g German Silver Wire ,,	2/9	..
h Gutta-percha, fine ,,	12/6	..
h India-rubber, Para fine ,,	1/2½	½d. inc.
i Iron Pig (Cleveland Warrants) per ton	Nom.	..
i ,, Wire, galv. No. 8, P.O. qual. ,,	£29	..
g Lead, English Pig ,,	£35 5s.	10/- inc.
g Mercury per bot.	£9 10s. to £10	..
e Mica (in original cases) small per lb.	3d. to 3/-	..
e ,, ,, medium ,,	4/- to 8/-	..
e ,, ,, large ,,	10/- to 20/- & up	..
g Phosphor Bronze, plain castings ,,	..	..
g ,, ,, rolled bars and rods ,,	..	..
g ,, ,, rolled strip & sheet ,,	..	..
d Silicium Bronze Wire per lb.	1/3	1d. inc.
r Steel, Magnet, in bars ,,	1/6	..
n Tin, Block (English) per ton	£156 10s. to £157	£2 to £2 10s. in.
n ,, Wire, Nos. 1 to 16 per lb.	3/6	..
g White Anti-friction Metals per ton	£65 to £275	..

Quotations supplied by—

a G. Boor & Co.
b Thos. Bolton & Sons, Ltd.
c Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Water Power in Finland.—Mr. Hugo Malmi, one of the engineering members of the Finnish State Water Power Committee, which has under consideration the question of utilising the falls of the Imatre for railway and other purposes, states that so far only the smaller waterfalls in the country have been brought into use, although these represent a total of 200,000 h.p., apart from steam generating stations. It is calculated that if the consumption of power grows in the same proportion as in pre-war times, an additional 300,000 h.p. will be required in ten years' time. The Government proposes to combine some of the lesser falls with the Imatre, and the total amount to be paid for the expropriation of the former, and of adjoining land, has been appraised at 5,072,000 Finnish marks, which sum has already been sanctioned by the Parliament. It is not expected that the proposed hydro-electric works on the Imatre will be able to supply power for five years. The method of financing the undertaking has not yet been settled, but it is suggested that a joint stock company may be formed for the purpose and the State hold a large financial interest therein, particularly as the State railways are to be converted to electric traction.

The Imatre scheme is said to have awakened interest in other countries, and foreign experts have visited the site of the projected works, and also sought information on the question at the office of the Water Power Committee.

Reduction of Electrical Fires in the United States.—According to a recent compilation it appears that out of 138,553 fires which occurred in 1919, only 3,568, or 2.57 per cent., were of electrical origin. More recent reports state that in Cambridge, Mass., in 1920 there were 780 alarms, with a total fire loss of $431,905. Only one fire was of electrical origin. In Springfield, Mass., there were 1,002 fires, with a total fire loss of $360,115, of which only three were due to electrical causes. In Carthage, Mo., there were 64 fires, only one being caused by defective wiring. It is said that 56 cities and towns have reported no fires of electrical origin during 1920. The total fire loss for these cities and towns was over $1,600,000.—*Scientific American.*

RESEARCH ON INSULATING OILS.

The Selection of the Best Form of Spark Gap for Dielectric Strength (Breakdown Voltage) Tests.

We have received from Mr. E. B. Wedmore, director and secretary of the British Electrical and Allied Industries Research Association, the following communication :—

This problem is one of those arising out of researches initiated by the Institution of Electrical Engineers, which has been transferred to the Electrical Research Association, and owing to the importance and immediate value of the results obtained, it is decided to make some of these public in advance of other information.

These results lead to the conclusion that spherical electrodes should be employed, and it is recommended that they should be half an inch in diameter and spaced 0.15 inch apart. Such electrodes prove to be very sensitive to the presence of contaminating particles of moisture and fibrous and other material. The use of spherical electrodes admits of an accurate calculation of the maximum stress to which the oil is subjected.

The Association is indebted to Mr. A. R. Everest and the British Thomson-Houston Co., Ltd., for a valuable contribution to this subject contained in a report summarised below, which establishes two facts of the first importance :—

1. That different forms of electrodes show widely different degrees of sensitiveness to the presence of contaminating matter. The uniformity of results obtained by the use of a needle point electrode is proved to be due to want of sensitiveness of such an electrode to the presence of contaminating matter, and therefore indicates the unsuitability of this type of electrode for the purpose in question.

2. That the relationship between the test results obtained with different kinds of electrodes cannot be expressed by fixed ratios because the results are dependent upon the quality of oil tested with special reference to the amount of contaminating matter it contains.

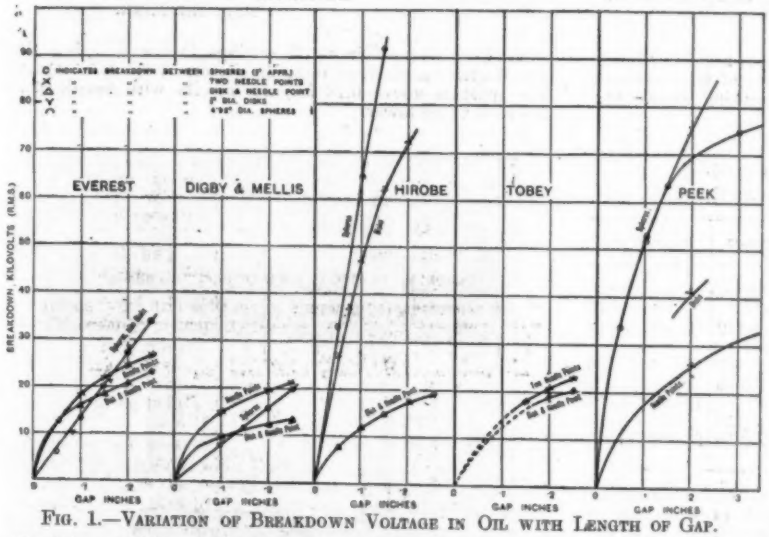

Fig. 1.—Variation of Breakdown Voltage in Oil with Length of Gap.

Influence of the Form and Dimensions of Spark Gaps on the Observed Breakdown Voltage in Oils.

Various types and settings of spark gaps are in use for commercial testing, principally :—

½-in. disks spaced 0.2 in. apart.
1-in. disks spaced 0.1 in. apart.
½-in. spheres spaced 0.15 in. apart.
Needle points.
Point and disk.

It is desired to ascertain the relation between them, and the relative merits of each type.

Table I shows the results obtained by various investigators (including the present investigation) with several different types of electrodes, and in each case with a gap setting 0.15 in. The tests are arranged in the order of goodness of the oils indicated by the sphere-gap tests.

By examination of the figures it will be seen that the effect of thoroughly drying and filtering the oil shows up to the most marked extent in tests with sphere gaps; to a somewhat lesser extent with disks; while *tests with needle points or point and plate do not indicate the quality of the oil as regards wetness or dirt.*

The relative values of results obtained with different types of electrodes on a particular oil depend therefore upon the quality of the oil itself.

TABLE I.

R.M.S. Breakdown Values with a Common Gap Length 0.15 in.

Investigator.	½" spheres gap 0·15".	½" disks gap 0·15".	Needle points gap 0·15".	Point & plate gap 0·15".
Tobey, 1910 (1)	—	—	18,000	16,500
Digby and Mellis, 1910 (2) ...	11,500	—	17,500	11,000
Present investigations ...	20,000	20,000	22,000	18,500
American National E.L. Assn. transformer standard (3) ...	40,000	29,000*	—	—
Peek (4) specially dried and filtered oil	64,000	31,000†	22,000	—
Hirobe (5), do., do.	92,000	62,000	—	15,000

1. A.I.E.E., Vol. XXIX, 1910.
2. I.E.E., Vol. XIV, 1910.
3. Report of the Electrical Apparatus Committee, National Electric Light Association, June, 1917.
4. G.E. *Review*, August, 1915, and elsewhere.
5. "Electrical Insulating Properties of Transformer Oil," Report No. 25 of the third section, Electrotechnical Laboratory, Tokio, Japan.

The Present Investigation.

This was initially undertaken to establish a basis which would permit the correlation of measurements taken with different types of spark gaps upon commercial oils.

The conditions were, therefore, arranged to secure the following features :—

(*a*) A good commercial grade of oil.
(*b*) Neither unduly dry nor unduly wet.
(*c*) Uniformity in quality throughout the tests.
(*d*) Precautions to avoid false results due to foreign matter on the spark gaps and testing vessels.
(*e*) Tests with each type of spark gap to cover a working range up to above 30,000 volts.

Oil Tested.—The oil used was the Vacuum Co.'s Gargoyle A.F. in the condition received; it was brought to the laboratory in two 5-gallon steel drums which had been properly cleaned, dried and filled from one large drum.

The Electrodes.—The electrodes used, as shown in fig. 5, were two ½-in. dia. spheres, two ½-in. dia. disks, two needle points and a needle point with a 1-in. dia. disk. The sphere and disk electrodes were of brass mounted on brass rods tapped with a 2 B.A. thread. The needle point electrodes consisted of gramophone needles ("His Master's Voice") held in split brass tubes. These needles proved to have points with a radius of 0.0018 inch. New needles were fitted after each breakdown, except in one or two tests with the 0.05 in. gap. In the case of the spheres, fresh points on the surfaces were brought opposite each other after half the total number of breakdowns had been made. The lengths of the gaps were adjusted to hardened steel gap gauges. In all cases the common centre line of the electrodes was horizontal.

The Containing Vessel.—The tests were made in a small rectangular glass cell, the oil being 1 in. above the electrodes.

Cleaning the Electrodes and Container.—The dielectric properties of oil being much affected by the presence of fibrous dust, the following precautions were taken to remove such dust left on the electrodes and the inside of the containing vessel after cleaning them with cotton cloths :—

A small quantity of oil was introduced into the containing vessel and the gap between the electrodes adjusted. The potential of one of the electrodes was then raised as high as possible without causing a breakdown in the oil in order to attract the dust particles to the electrodes and into the region between them by the electrostatic force. After about a quarter of a minute the electric potential was removed, the electrodes taken out and washed by pouring fresh oil over them, and the oil in the containing vessel poured away.

* The N.E.L.A. (Ref. 15) gives 40,000 V with ½-in. spheres as equal to 22,000 V with 1-in. disks spaced 0.1 in. apart. Other determinations show that this corresponds to 29,000 V. with ½-in. disks spaced 0.15 in. apart.

† Peek states that the oil gave 41,000 V r.m.s. tested between ½-in. disks spaced 0.2 in. apart.

This process of collecting and removing the dust particles was repeated two or three times after the cleaning of the electrodes with a cotton cloth, after which from 20 to 25 breakdown tests would be made before the electrodes were again cleaned.

Procedure of Test.—The r.m.s. value of the breakdown voltage was recorded for each oil sample, and only one breakdown was made with a sample. The mean of ten such readings with a particular gap length was taken as the breakdown voltage corresponding to that gap length. The voltage at which the first preliminary spark passed in each sample was also observed; with the two needles and needle disk electrodes, the sparking was violent and almost continuous at potentials just below the breakdown value.

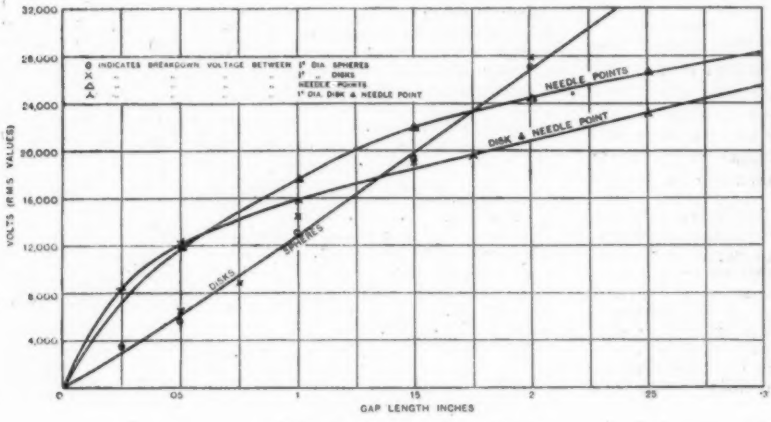

FIG. 2.—OIL SPARK-GAP TEST.

Results.—The average breakdown values are shown on curves in fig. 2, each point being the mean of ten readings. Both the breakdown and preliminary sparking values are shown in Table II.

TABLE II.

(Average) Values Observed (r.m.s.).

B.D. = Breakdown. P.Sp. = Preliminary Sparking.

Spacing.	½" spheres.		½" disks.		Needle points.		Point and plate.	
	B.D.	P.Sp.	B.D.	P.Sp.	B.D.	P.Sp.	B.D.	P.Sp.
0·025"	3,570	2,940	—	—			8,430	7,075
0·05"	5,712	4,354	6,510	4,680	11,950	8,140	12,250	8,256
0·075"			8,950	6,220				
0·100"	13,185	7,583	14,500	7,380	17,760	13,500	15,980	11,810
0·15"	19,530	11,140	19,060	11,070	22,090	16,300		
0·175"							19,660	14,680
0·200"	27,160	15,340	27,900	22,080	24,400	18,750		
0·250"					26,730	20,390	23,340	17,360

In order to determine the errors which might be introduced by burning of the needle points by spark or otherwise, a special test was made, from which it was found that the

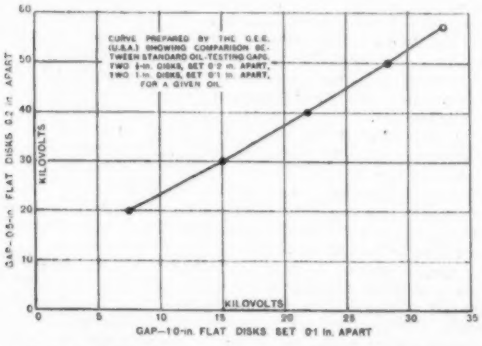
CURVE PREPARED BY THE G.E.E. (U.S.A.) SHOWING COMPARISON BETWEEN STANDARD OIL-TESTING GAPS, TWO ½-in. DISKS, SET 0·2 in. APART, TWO 1-in. DISKS, SET 0·1 in. APART, FOR A GIVEN OIL
GAP—0·5-in. FLAT DISKS 0·2 in. APART
KILOVOLTS
GAP—1·0-in. FLAT DISKS SET 0·1 in. APART

FIG. 4.—COMPARISON BETWEEN OIL-TESTING GAPS.

burning of the needle point by arcing did not sensibly affect the result, so long as the spacing was maintained.

GENERAL DEDUCTIONS.

Spheres and Disks.—Two ½-in. disks and two ½-in. spheres at the same spacing have practically equal values for oil not abnormally dry and clean, and within the range of test values generally employed in commercially checking the quality of the oil.

As indicated in Table I, spheres give higher values than disks for oil which is extremely free from moisture and dirt.

½-in. Disks and 1-in. Disks.—The relation between ½-in. disks spaced 0.2 in. and 1-in. disks spaced 0.1 in. apart has been carefully determined by the General Electric Co., U.S.A., for oil in commercial condition, and is shown in curve fig. 4.

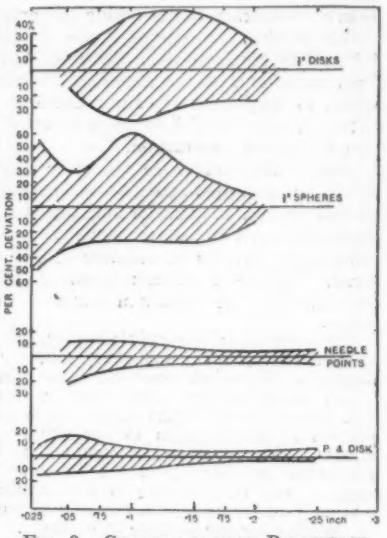

FIG. 3.—CURVES SHOWING PERCENTAGE DEVIATIONS OF INDIVIDUAL READINGS FROM THE MEAN.

Needle Points.—For small settings (below 0.18 in.) these give higher values than disks or spheres at the same spacing. For spacings above 0.18 in., the results with needle points are seen to be lower.

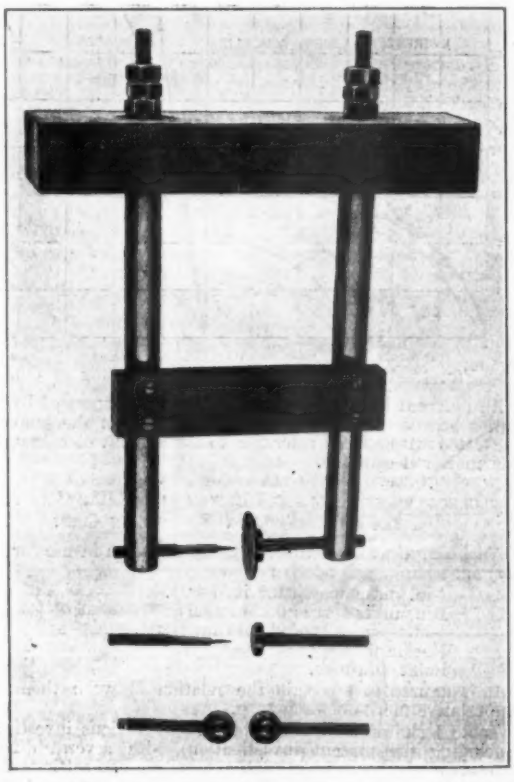

FIG. 5.—ELECTRODES USED IN THE TESTS.

As indicated in Table I, tests with needle points do not indicate the quality of the oil as regards wetness or dirt.

Point and Plate.—For small spacings and with the plane of the plate vertical, these give results very similar to needle points. Examination of numerous records shows that results in general depend largely upon the diameter of the plate (particularly with other than small spacings), and also upon

the position of the plane of the plate, i.e., whether horizontal or vertical.

Irregularity of Readings.—Curves in fig. 3 show the per cent. deviations of the individual readings from the mean of each set. It will be seen that with oils of the character tested, the widest deviations occur when tested with spheres or with plates, while readings with needle points (or point and plate) are much more uniform. This is associated with the fact noted above, that tests with needle points do not indicate the presence of moisture or impurities.

Preliminary Sparking.—The observed values of the first preliminary sparking (P.Sp.) are shown in Table II. When testing between needle points, or between point and disk electrodes, the sparking was violent and almost continuous at potentials just below breakdown value.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Inaugural Address,

By J. S. HIGHFIELD, *President.*

(*Abstract.*)

(*Concluded from page* 659.)

I hope to see more engineers take a scientific interest in the finance of the works they control and design, so as to help in their better management. It should be realised that savings are invested in enterprise only with the hope of profit, and that those who shoulder the responsibility for financing industry carry a very heavy burden. On this subject I quote the words of Lord Kelvin on retiring from this Chair on January 9th, 1890. They show the wonderful range of his sympathy and understanding.

"The Institution of Electrical Engineers has for its province practical applications of electricity and allied branches of science. But science, whether of electric instruments or of nautical operations, or of the heavy engineering work of stress and strength of materials and machines for working with cables in depths of from two to three nautical miles, cannot go on without the sinews of war; and I feel that those who have supplied the sinews of war, and have stood by from the beginning of the submarine cable enterprise up to the present time, ought not to be forgotten by an Institution of Electrical Engineers. . . . Sir John Pender gave a guarantee of a quarter of a million sterling for the funds required to complete the enterprise of two cables across the Atlantic. Without that guarantee many and many a year would have passed before we should have had the Atlantic crossed by cables, and before ocean telegraphy would have had the great advance it has had. I repeat that a Society of Electrical Engineers has a double duty—a duty to science, to get all the good it can out of science; a duty to satisfy those who pay for the work that the work is good, a duty to encourage them to bring forward new work and to show that new enterprise has a chance to be successful."

Bearing this double duty in mind there is much technical work in front of engineers that will tend to the expansion of business.

A reduction in the cost of transmitting electricity is of first importance. We are far from the end of invention in this matter; new methods are required. There is more water power available in this country, and especially in Wales and Scotland, than has been realised, and in this connection the work of the Water Power Resources Committee—consisting largely of our own members—is to be commended. But the fullest use of these resources depends on cheap transmission. The cable makers have done much to help, and have succeeded, despite increased costs, in improving the design of cable so as to transmit electricity at little more than the cost before the war. The greater facilities for overhead lines given by the Electricity Act are useful, and should give opportunities for providing electricity in many districts, especially rural districts, impossible by underground cables. Attention should be directed to the means of connecting the lines to the consumers' apparatus; switchgear and other subsidiary plant should be simplified even at the expense of security, in order to reduce cost. In the past we have been very careful to provide a secure supply, but in view of the reduced wealth of the nation, I think we have gone too far in this direction. Many manufacturers are content to depend for the running of their mills and works on a single gas or steam engine, and suffer occasional stoppages, which they regard as events which cannot be avoided except at prohibitive cost. We can easily give greater security than this, without unnecessary safety devices or an undue amount of spare plant, and there is no sense in trying to provide more, since there is not the money to pay for it. In short, our attention should be directed, and in fact is being directed, to amending design so as to reduce cost.

On the management side of the business, there is the important problem of arriving at a satisfactory tariff. The introduction of the wire lamp, and its general use about 1910, resulted in the cost of lighting by electricity being reduced by one-half; further improvements in lamps have resulted in the cost of electric lighting, as compared with the cost in 1908, being reduced by about one-half, so that the revenue from the lighting of small premises is now so small as not to pay the cost of service charges. In short, the lighting consumer has not paid his fair share of the increased cost. The result is that in many districts the cost of electricity for power and heating has, of necessity, been retained at too high a figure.

It is now generally realised that the tariff should be arranged so that two meters are not required. It is most desirable that the consumers should obtain the benefits of electricity for all purposes without being put to the cost of double wiring. This necessitates a system of charging which will enable electricity for all purposes to be supplied through one meter on what is known as the "contract system" or "two-part tariff." The Electrical Development Association has done excellent work in pressing that the "two-part tariff" should be made a legal tariff. Before the war, in thousands of cases, the "contract system" was used, the alternative being a flat rate of, say, 8d. per unit. Owing to the great increase in cost, it has not been possible to maintain the "contract tariff" with a maximum price of 8d. per unit, and the system has fallen into disuse, but since practically all items of cost are at the present time twice what they were in 1908, the logical thing would be to double the maximum price. This would enable the price for lighting to be raised to a reasonable figure and would avoid the necessity of overcharging for power and heating. It would also enable the "contract" or "two-part tariff" to be put into use at once, with its resulting benefit to the industry and to the consumer.

Apart from this technical work, progress in electricity supply rests first on a general determination to cease talking and to get to work. We must necessarily depend for guidance on the Electricity Commissioners, and I am sure the general view, and certainly my own, is that they provide for the supply industry a skilled tribunal in which increasing confidence is being placed. They have a very difficult task to perform, and all the help we can give them should, and will, be given.

The difficulty of their task was enormously increased by the Act that gave them a constitution. It gave them too little freedom from political control. It equipped them with duties both executive and judicial. This combination of duties necessarily increases their difficulties and, if my humble opinion be of any value, they should concentrate on the judicial and advisory side of their work.

Among the duties of the Commissioners is the fixing of maximum prices, and I have unfortunately found a tendency to exercise too much control, a tendency to fix the actual selling price and not the maximum price. Before the war there was a wide margin between the price charged and the maximum price, and the margin is necessary to meet contingencies. There has been delay in dealing with applications. I think that we had all hoped that our Commissioners would be free from red-tape methods, but I am sorry to observe signs of that baffling material.

The question is important to us all, not only to the electricity supply industry. In my own direct knowledge, several hundred thousand pounds have been lost to the industry through delay, most of which would have been spent with electrical manufacturing firms for extension of plant and cables to supply waiting consumers with the electricity they desired.

I make these remarks in no carping spirit. I am sure the Commissioners, men whom many of us know and greatly respect, desire to form an ideal Government office; and I think it is doing them a disservice to allow faults to pass unnoticed, and I know they will not resent fair criticism which is one of the sources of efficiency. The efficiency of a Commission, possessing far-reaching powers, is vital to the electricity supply industry, and to the whole manufacturing industry of which it is the foundation.

Any public service must of necessity be subject to some degree of control. The important matter is that this control be directed with understanding and with sympathy. There is, I am sure, a general belief that these qualities will be shown by the men chosen as Electricity Commissioners. Their efficient work will depend on close co-operation and firm trust between them and the industry; given this, the Commissioners should be of great service in removing, in a fair way, all those obstacles which have, for so long, restricted full development.

What are the main obstacles to rapid progress? The first, I think, is a feeling of uncertainty and insecurity, unfortunately created by the Electricity Supply Bill as first presented. This threatened the existence of every company undertaking and contained admittedly unfair proposals for purchase of both municipal and company works by new State-aided boards. These boards were to carry out in all industrial districts the work for which the power companies were established with Parliamentary sanction. This feeling of uncertainty still exists in spite of the fact that in the Act this feature was removed.

This feeling can be dissipated only by a clear proof that in any scheme the existing rights both of companies and of municipalities will be respected. The restoration of confidence by a feeling of certainty that such is the policy of the Commissioners, is of the first importance.

Second in importance, I think, is that companies and municipalities should realise that they are both charged with the duty of providing the public with electricity, and should help each other to supply it in the least expensive way. I was

delighted to welcome the address of the President of the Incorporated Municipal Electrical Association. It is a courageous and just statement of the proper relations of companies and local authorities, and, if the advice be acted on, it should not be long before real progress is made in electricity supply.

The third obstacle to progress is the purchase clause in Provisional Orders. The 21 years' clause in the Act of 1882 absolutely stopped progress for six years. The present clause severely hampers the industry, and I should like to see it revoked unconditionally. I am aware that this is a radical suggestion, but I do not make it lightly. No single change would do more to promote enterprise and to supply the public at the least cost; any conditions must necessarily be paid for by the consumer. All the technical improvements in sight would not produce the beneficial results that would follow this change. It would enable much obsolete plant to be scrapped which now must be kept. It would give heart to the director who desires to raise more capital and to push forward his business, but who dare not and cannot raise money, when he may be forced to sell the undertaking in a few years. There would not be the very necessary tendency to keep prices as high as possible, in order to provide a sufficient reserve to purchase new plant to continue the business, and to provide for an unknown future. Again, the waste consequent upon a change of ownership of a great public business is enormous, and results in an increased price to the consumer.

The difficulty about the change is that the right of purchase is a Parliamentary bargain. The local authorities are entitled to enjoy it, and the difficulty can be overcome by their good offices alone, but since their desire is to benefit the general body of ratepayers, and since cheap electricity is so desirable, I hope they may consider the suggestion in the most liberal spirit and try to find a solution of the difficulty.

For dwelling on matters of money and trade my excuse is the present very serious state of business generally, and the urgent necessity to rebuild our export trade. This depends on a healthy home trade; home and export trades are mutually dependent; and since the prosperity of one trade usually helps others, I hope that all our members, while actively pushing their own business, will do what they can to help their friends. In this connection, the buying of goods from abroad is a matter that requires attention. The reasons for buying foreign plants are often sufficiently good. At the same time, it should be recognised that the price paid to the foreigner is not necessarily the whole sum paid; some portion of the price may take the form of increased payments in taxes and rates to provide for unemployment at home.

At the present moment profit is no longer earned by the great trading community of these islands, and, in consequence, many are wanting work and many are in distress.

As a trading community, we must reduce cost and increase output, and also, where possible, the reserve, and we must, as any trader has to do at times, reduce prices to re-open markets, even if an apparent loss results, and all concerned must shoulder their share of the loss.

Each trade, and each trading association, must attend to its own affairs and restore its own profit, to lead to the common end of restoring national prosperity. Masters should instruct their men and make clear the conditions for success. They are taking more trouble in this matter than has been usual in the past, and I have no doubt that the result will be a common understanding and co-operation between masters and men such as has not been known for years.

North-Western Centre.

Liverpool Sub-Centre.

On November 7th Mr. G. H. Nisbett, chirman of the Sub-Centre, read his inaugural address, of which an abstract follows:—

As time goes on, that part of the electrical industry connected with power and lighting supplies is more and more dependent for its prosperity on the enterprise of the Electricity Supply Authority, and of the wiring contractor. It is only to the power and lighting consumer at present unconnected that we can look for new business, and it seems to me that power supply has been unduly boomed to the neglect of the greater possibilities of lighting. The cost of power to the average factory, eliminating exceptional cases such as rolling mills, &c., is no more than 1 per cent. to 2½ per cent. of the cost of the finished product. It is evident, therefore, that power supply need not be considered from the point of view of furthering any national object, but only with a purely business outlook. The profit obtainable from power supply will always be strictly limited, because the saving effected at a central station compared with power generated locally is largely offset by the cost of and losses in transmission.

Now, the lighting side of the business seems to be in a very different position. In a private house convenience comes a long way first, and cost is quite secondary. Moreover, the consumption of energy by the average lighting consumer is so small that it is out of the question for him to put down his own plant. Electricity as a means of illumination stands without a rival—one cannot imagine a single dwelling house being without a supply if only the initial cost of wiring could be overcome; all new houses, even workmen's cottages, are wired as a matter of course, so that the daily cost does not stand in the way of even the poorest of us. This is evident from the fact that many districts have raised their price for lighting to 10d. and even 1s. per unit without the loss of a single consumer.

It follows that, electric lighting being so much more of a monopoly than power supply, very much higher profits on the turnover can be obtained, and generally are obtained. This fact has been presumed upon in many districts to subsidise power supply at the expense of the lighting consumer.

I hope I have said enough at least to call the attention of supply authorities to this question, and perhaps induce them to give the potential lighting consumer some added encouragement to wire up and use the supply. I am not suggesting the neglect of power supply, but rather the cessation of the neglect of the lighting side of the business that has taken place. The average man gets very little encouragement to become a consumer. The supply is given him inside his front wall, and he is left almost entirely to his own devices as to how to utilise it. He is told that he must get a contractor to wire his house, and has to make the best bargain he can, not knowing in the least what he ought to get for his money, or having any guidance in the art of illumination. It is necessary to see that he is saved from as much trouble as possible, and is assured of a sound installation at a reasonable price with a suitable number and disposition of lamps. To ensure this, I suggest that the Supply Authority should make itself responsible to the consumer for the wiring of his house; quote him a price for his wiring, and see it properly carried out both as regards quality of work and position and size of lamps. The authority would previously have made a list of approved wiring contractors in the district, and should prepare a specification to which the wiring contracts would be let, having in mind desirability and cheapness. Having obtained a consumer's order, it should sub-let the contract, without profit to itself, to one or other of the wiring contractors. Or as an alternative, the authority should act as consulting engineer for the job. This advisory work should be free of charge, as the authority receives its remuneration in the after business done with the consumer.

Both these proposals ensure good work and the avoidance of unnecessary cost, but bearing in mind that the great deterrent to a large expansion in lighting business is the initial cost of wiring to the consumer, I suggest that the supply authorities should themselves pay for the wiring and make no initial charge at all to the consumer, recouping themselves for the cost, either by an addition to the price per unit or by a separate rent charge.

Many years ago now I started the "free wiring" idea, and was instrumental in forming a company for the working of it. It undoubtedly brought a large influx of new customers on to the mains of those who adopted the system, but it broke down in practice because of legal difficulties. Now, however, that supply authorities have power to provide and let out on hire wiring and other apparatus, there are no difficulties in the way, and ample interest could undoubtedly be earned on the extra capital expenditure.

I seriously suggest to supply managers that they should carefully consider the possibility of offering to wire, up to the ceiling roses or equivalent, any premises for which supply application is made to them, provided they are satisfied that there will be reasonable usage.

Under the present system the total capital cost to the electricity works per lighting point connected to the mains averages about £2 5s., whereas the cost to the consumer of wiring from the main cutout to the ceiling roses or equivalent costs to-day is, say, 30s. per point. So that of the total capital of £3 15s. (excluding fittings) necessary for complete supply, only 60 per cent. is found for the consumer and the other 40 per cent. he has to find himself. A householder generally has his premises only on a short lease or a tenancy of a year or two, the law being such that from the moment he fixes his wiring its ownership passes from him, and he only has the use of it during his tenancy. Would anyone but an enthusiast spend his money under such circumstances?

By providing the wiring free of initial expense, the consumer's chief difficulty would be met, with results that would much more than outweigh the additional responsiblity assumed by the electricity works. The wiring so provided would, of course, remain the property of the authorities, and its continued possession to them is secured by clause 23 (2) of the Electricity Supply Act of 1919.

The proposal that the authority should find the wiring instead of the consumer and charge him a commensurately higher price per unit or a separate rent charge for it would in fact cost the consumer rather less than he would pay *in toto* under the present system, the reason being that the cost of both money and materials is less to the authority than the consumer. A charge of 3s. per annum per point would about cover the cost, or an extra charge per unit of about 2d. would on the average provide an equivalent sum.

The next point I would urge in view of the stumbling-block of cost is the simplification of wiring. One has only to look at our Institution Wiring Rules to see how far complication has gone in what is, after all, a very simple business. If we bear in mind that the problem only consists of running a wire from a fuse to a switch, then to a lamp, and thence back to another fuse in such a way that the current is confined to the wire, we see how far the electrical engineer has gone in strangling himself with red tape.

We have been hopelessly handicapping our business for the

sake of the fire insurance companies, and I suggest that all we are called upon to do is to give a reasonable modicum of safety, bearing in mind that perfection can never be reached, and that the attempt to eliminate the last element of risk can be too dearly bought.

Of the various systems of wiring, the conduit system is probably the most costly of any, and to my mind much the most unsatisfactory in practice. I have seen cases in which a lot of money has been spent in installing the conduit system under the impression, as I think, that elimination of fire risk was thereby effected, and then the supply authority has shown its contempt of the whole thing by installing its apparatus close under a wooden staircase and bunching the rubber-covered wires in tortuous heaps behind a wooden board on which the meter, &c., was mounted.

I am an advocate of either lead-covered wire throughout (the lead being bonded and earthed) or of going back again to the original system, namely, rubber cables in wooden casing where otherwise exposed and supported by porcelain cleats in such places as between floor and ceiling. I believe the lead-covered system to be a better job electrically in every way than the conduit system, and infinitely more durable. It is also much cheaper unless the cost is loaded unnecessarily by providing armour or other protection to prevent the remote possibility of damage to the cable. If the fuses are really efficient, there is no need to spend a lot of money in trying to ensure that conditions are made so safe that the fuse can never act.

The next thing that seems to require attention is the standardisation of fittings, particularly wall plugs. Nothing is more annoying to the consumer than to find that the plug supplied with a new lighting or heating fitting that he has bought will not fit into any of his existing sockets. A great deal of revenue is at present being lost owing to this want of interchangeability of plug. Lampholders and lamp caps require similar attention. Fuses also should be standardised.

I take this opportunity of drawing attention to the deplorable quality of many of the electrical fittings that are at present on the market, and are being used in practice by probably the majority of wiring contractors, owing to the stress of competition. These fittings form only a small percentage of the total cost of a complete installation, so that there is no economic excuse either for their manufacture or use. I have looked over samples of fittings taken from a stock heap and bought in the ordinary way (all these are of British manufacture) and I find the following obvious faults:—

Lampholders.—Brass casing parts much too light, weighing 1 oz. in all, as compared with 2¼ oz. a few years ago. Material too thin to allow of a full thread to shade ring. Contact screws too short, so that they bottom on the head when the point is 1/32 in. from the wall of the hole. Travel of contact plungers varies from 1/32 in. to 3/32 in. Internal diameter of socket varies by 1/32 in. between one make and another; cord grips drilled too small for standard flexible.

Switch Lampholder.—The key type should be prohibited, as its use involves severe bending of the flexible. Pressel type.—I found the wooden cover only engaged one thread, as did the cord grip socket before the insertion of any flexible. The brass contact strips were left black from the annealing. If the push bar was pressed over only 1/16 in. short of its full stroke, no contact was made.

Ceiling Rose.—Porcelain cover only engages for three-quarters of a thread, although three threads are provided. The weight is taken off the terminals by passing the flexible cord through holes in a bridge, these holes having dead sharp edges. The contact plates are so thin that terminal screws only engage by one thread. Terminal barrels are badly fixed to contact plates. Caps and bases are not interchangeable.

Wall Plug.—No cord grip is provided, the fastening of the fibre plate by screws into the porcelain top is most unsatisfactory. Plug and base cover are often made of wood, and this for a fitting that is perhaps more likely to give rise to heating than any other. No attempt has been made to take off the burrs, even at contacts. Plugs out of round, due to a wide saw cut, and the permanent compression of the soft brass. Diameter of the plugs appreciably less than the diameter of the sockets, so that contact only results from the accident that the plugs have not been set on the same centres as the sockets.

The *adaptor* was not provided with a cord grip, the terminal barrels were only 7/32 in. diameter, and the holes in them for the wires were full of burrs. The thread of the wooden cover was "drunk" and badly chipped, and it was only screwed into position at the third attempt.

The *tumbler switch* was perhaps the most satisfactory of all, but here the brass cap was much too light, the threaded portion very apt to break away, and in any case in the samples examined it frequently only engaged with one thread. The contacts were of soft copper and the spring was of poor quality.

I have, I think, said enough to show that serious attention needs to be paid to this matter, and I suggest that it is to the interest of the supply authority to see that none but reliable fittings are used on their circuits, as nothing gets electric lighting so bad a name as the small annoyances the user of electricity is subject to at the present time, because of petty troubles that should not occur.

It would pay both directly through the meter readings and indirectly in increased satisfaction to the consumer if the authority would send a sufficiently trained official periodically to visit each consumer. Such a man should call twice a year as a minimum; he would inspect the whole of the installation and see that it was in working order, carry a small bag of tools and do small repairs, such as renewal of flexibles, tightening of terminals, &c., then and there. He would also advise as to the candle power and disposition of lamps if dissatisfaction was expressed, and last, but not least, he could canvass for orders for new business by drawing the householder's attention to the advantages of electric irons, kettles, and cooking or other apparatus, with which the consumer did not happen to be provided. Such a representative could be a woman, perhaps with advantage, seeing that calls would be made mostly when only the lady of the house was at home.

Still another point to which I should like to draw attention is the need for greater care in the earthing of appliances, such as kettles, irons and cooking appliances.

From the tenor of the last part of my remarks one might think that I was desirous of increasing the cost of wiring rather than reducing it, but reasonable freedom from risk to life is essential, and money spent in effecting this can be saved many times over by simplification of the wiring itself, and by cutting out all the fads that have grown up around it.

There are authorities—and they are by no means confined to municipal ones—who presume on the monopoly they have and take advantage of their position to impose irritating restrictions upon the consumer.

There would seem to be urgent need for increased support to the Electrical Development Association. Everyone seems to be agreed that it is doing good work in boosting the use of electricity, but the funds at its disposal are obviously inadequate for the purpose.

There is yet plenty of opportunity for us to reap the fruits of enterprise. It is doubtful if on the average more than 20 per cent. of the private houses are yet wired for the electric light, so that in this direction we have still before us and waiting the doing, given reasonable conditions, an amount of business aggregating about four times all that we have done up to date.

In conclusion, I hope that nothing I have said will be taken to be in any way a reflection upon the supply manager or the wiring contractor. Both these classes have generally shown much enterprise, and we have none of us the least reason to be dissatisfied with the progress made in electricity supply, especially during the last few years.

There remains, however, much more to be done, and I do urge that if only in the interest of the trade generally, supply authorities should now review the whole position afresh, and without prejudice in favour of hampering customs that have grown up round the business, solely, I believe, because of the Parliamentary terms under which the various franchises were granted, they should see if they cannot so modify the conditions of supply as to immediately secure a large proportion of the additional business that undoubtedly remains to be done.

South Midlands Centre.

In his inaugural address which he delivered at Birmingham on November 2nd before the above named centre of the Institution, Mr. R. A. Chattock, who has been elected to the chair for the second time, discussed the scheme that has been submitted to the Electricity Commissioners to deal with the South West Midlands Electricity District,* and in connection with which the Commissioners commenced a local inquiry on November 15th. In outlining what led up to the preparation of the scheme† and explaining some of its technical details, Mr. Chattock said, *inter alia*:—

Sufficient evidence has been forthcoming to show that the working of Joint Electricity Authorities is likely to be attended by considerable difficulties, and the representation of the great number of interests involved in a district is likely to make the controlling body rather unwieldy. The combination of the interests of municipalities and companies on a single controlling board will be very difficult to effect. This is especially the case as regards finance.

In the South West Midlands District two existing undertakings are together responsible for the generation of about 98 per cent. of the total energy generated in the area, namely, the Birmingham Corporation and the Shropshire, Worcestershire and Staffordshire Electric Power Co. They felt that they were justified in suggesting that the control of generation in the whole of the district should be placed in their hands, and have consequently submitted a joint scheme to apply to the whole of the South West Midlands Electricity District, the proper control of which is proposed to be effected without the formation of a Joint Electricity Authority.

An Advisory Committee will form a connecting link between the Electricity Commissioners and the various authorities in the district.

By centralising the generation of electricity and locating the stations as near as possible to the bulk of the demand, advantage can be taken of the very low cost of production and the cost of transmission is brought to a minimum. The demand will grow at a slightly greater rate than that obtaining before the war, and whereas the cost of generation to-day is about 0.96d. per kWh, the cost in 1925 will be about 0.44d.

* Elec. Rev., October 1st, 1920, p. 434.

per kWh, or a reduction of 54 per cent. In 1930 the cost will be about 0.33d. per kWh, or a reduction of 65,7 per cent. Such a result must have a very material effect in cheapening the cost of electricity to the consumer, which is the real object of the present development that is going on in the country.

Mr. Chattock concluded with a short description of the leading features of the Nechells power station.

AERO ENGINE IGNITION.

Research Committee's Reports.

Several reports of electrical interest by the Internal Combustion Engine Sub-committee of the Aeronautical Research Committee (which are obtainable from H.M. Stationery Office; price 3d. net each) have recently been issued. The first No. 1, January and February, 1916 (I.C.E. 11), is a summary of the researches on magnetos that were carried out at the National Physical Laboratory by Messrs. A. Campbell, B.A., and D. W. Dye, B.Sc., and deals with (1) spark tests of a magneto with a series of magnets of widely different magnetic qualities, and (2) the nature of the current in the spark circuit of a magneto.

The report states that the efficiency of a magneto for ignition purposes depends on the quality of the permanent magnet (or magnets) used. If it be assumed that the efficiency of ignition depends on the energy per spark given by the magneto, then (so far as the magnets are concerned) the chief questions to be answered are: (1) Upon which of the magnetic properties of the magnet does the energy per spark chiefly depend? (2) What are the laws of this dependence? (3) What determines permanence of behaviour?

In testing permanent magnets for general use, the two properties which are usually of most importance are the remanence and the coercive field (or force). The remanence indicates the ability of the material to become a strong magnet, while the coercive field measures its capability of remaining permanent under the action of a demagnetising field. High coercive field also is found to ensure good retentiveness of magnetism against the demagnetising effect of mechanical vibration, shock, &c. This remark appears sufficient answer to question 3. The experiments here described relate to questions 1 and 2, and had for their object the investigation of the manner in which the output of a magneto at various speeds is dependent on the coercive field and the remanence of the magnet used, the coercive field, however, being the property mainly considered. In tungsten steels used in practice for permanent magnets the coercive field may vary within far wider limits than the remanence. (The present investigation had no concern with the connection between the magnetic properties of the magnets and their chemical analysis, heat treatment, &c.)

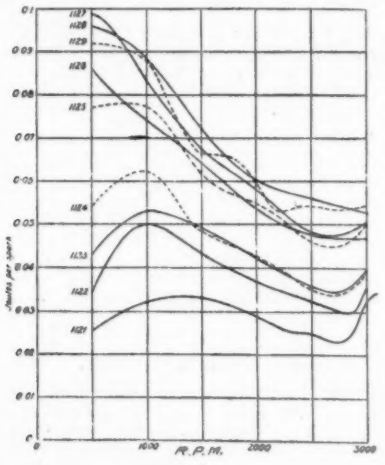

Fig. 1.

The magneto was of small type ("M.L."), arranged to work with a single wide permanent magnet. With it were supplied nine magnets of similar dimensions, and the series covered a wide range of magnetic quality. Each magnet was tested for coercive field and remanence, using an initial magnetising field of 400. The tests were arranged to give as nearly as possible the average values of each of these quantities over the whole length of the magnet. The first two columns in Table I give the values obtained.

The output of the magneto with a given spark gap was determined for each magnet at speeds of 500, 1,000, 1,500, 2,000, 2,500, and 3,000 r.p.m. respectively. The spark gap was between two brass spheres of 1.5 cm. diameter, and its length was fixed at 0.5 mm. in order to ensure that uninterrupted sparking should be obtained even with the weakest magnet and the slowest speed. The whole was enclosed in a carefully calibrated air calorimeter, and from the thermal observations the output (in joules per spark) in each case was deduced. The results (fig. 1) show how largely this output is dependent on the magnetic properties of the magnets. Table I gives, for each magnet, results averaged over the six speeds.

TABLE I.

Remanence.	Coercive Field. H.	10^{-4} B. × Rem.	Joules per spark. Mean of 6 speeds.
10,000	42	42	0.029,
10,500	50	52.6	0.038,
10,080	56	56.5	0.043,
9,500	61	58.0	0.046,
10,420	60	62.6	0.061,
10,200	59	60.2	0.062,
10,420	64	66.6	0.067,
9,480	69	66.4	0.070,
9,410	75	70.3	0.068,

To a first approximation, the energy per spark may be taken as proportional to the square of the product of the coercive field and the remanence; however, this conclusion only refers to the particular type of magneto used in the experiments.

It was discovered that the current in the spark gap circuit contained a very large component of high frequency. This was further investigated, and experiments were also made with ordinary spark plugs in air at pressures up to eight atmospheres and temperatures up to 200 deg. C. The following conclusions were arrived at:—

1. The current in the spark gap circuit contains a predominant component of very high frequency (of the order of 10 million cycles per second).

2. Only a small part of the power spent in the spark appears to be due to the high-frequency component. The total current may vary between wide limits without causing any considerable variation in the power.

3. Thus it appears that measurements of the total current may be very misleading if taken as a criterion of the behaviour of the magneto or its capability for supplying power to the spark. On the other hand, it must not be assumed that the relatively large high-frequency component of current has no influence, beneficial or otherwise, on the properties of the spark.

4. Determinations of the electrical power taken by the spark in producing ignition under working conditions are somewhat difficult, but from the above experiments it seems probable that power tests at atmospheric pressure with a spark gap of 0.5 mm. between brass balls 1.5 cm. in diameter pretty fairly correspond with the practical conditions in a cylinder.

(To be continued.)

EXPORTS AND IMPORTS OF ELECTRICAL GOODS FOR OCTOBER, 1921.

During October business in electrical goods and apparatus showed a decrease under all three heads—exports, imports, and re-exports. The comparative decline in the export total was not large, September's figure being £1,305,550. The fluctuations in the individual items were apparently normal. Imports fell by about 26 per cent., accounted for by reductions in the importation of carbons and unenumerated electrical machinery. The decrease in re-exports amounted to about 20 per cent. There were falls in the figures for telegraph and telephone instruments and apparatus and unenumerated electrical machinery, and an increase in the item "Electrical goods and apparatus."

Values of Electrical Exports and Imports for October, 1921.

	Exports. £	Imports. £	Re-exports. £
Electrical goods and apparatus	137,504	37,619	6,118
Insulated wire	271,132	13,140	141
Glow lamps	22,886	16,722	113
Arc lamps and parts	310	315	20
Batteries	42,858	6,153	—
Meters	36,511	2,821	1,228
Carbons	3,728	3,737	450
Electrical Machinery.—			
Railway and tramway motors...	3,120	—	—
Other motors and generators ...	178,301	—	—
Switchboards (not telegraph or telephone)	19,240	188	32
Electrical machinery (unenumerated)	135,006	27,887	1,565
Telegraph & telephone cable & material.—			
Telegraph and telephone wires and cable (not submarine) ...	145,872	4,308	192
Submarine telegraph and telephone cable	9,373	—	—
Telegraph and telephone instruments and apparatus	204,782	20,021	2,839
Totals	£1,210,623	£132,911	£12,696

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Prescot" Pillar.

Messrs. British Insulated & Helsby Cables, Ltd., have sent us particulars of their latest design of "Prescot" pillar. The accompanying illustration (fig. 1) shows the arrangement of one of these pillars.

The unit consists of a suitably stiffened enamelled sheet iron frame carrying porcelain insulators, upon which are mounted the copper cable and busbar terminals. The sealing chamber for the in-coming cable is screwed direct to the frame, and a compound-tight joint between the two parts is provided by means of packing. The sealing chamber is split to facilitate jointing and to avoid the necessity of breaking the compound-tight joint. Fuse clips may be readily changed without disturbing any other parts. The sealing chambers are supplied with brass glands, for plumbed joints to the lead covering of the cables and armour clamps are provided if necessary. Units varying in size are interchangeable, and can be added to or removed from standard pillars without the supply being cut off for more than a few minutes. The fuse carriers are of the shielded, cool handle type, and fitted with self-aligning contacts.

Mobile Electric Dock Cranes.

One of the principal Liverpool shipping companies, Messrs. Elder Dempster & Co., employ at the Toxteth Dock Sheds, Liverpool, about thirty mobile electric cranes of 7-cwt. lifting capacity (fig. 3) for handling goods in the dock sheds.

These cranes have been particularly designed for the stacking and unstacking of goods in warehouses or the like, and generally it is possible to work the cranes at stacks ten feet high. Being mounted on four ball-bearing road wheels, they can be easily towed by man or tractor power to work on any section of floor area, a trailing cable usually thirty yards long, being provided to supply the electrical energy for working. The motor and gearing for operating are mounted upon the centre post, and, when the crane is slewing, are effectually protected by a steel tower. The 4-h.p. motor is arranged for continuous running, and capable of withstanding severe requirements with very little rise in temperature.

The hoisting and slewing motions are operated by means of hand levers working friction clutches. To hoist a load, the hoisting lever (left hand side) is pulled towards the operator, this action simultaneously releasing the brake and operating the clutch for hoisting. To stop hoisting, the lever is pushed away from the operator, thus reversing the previous operation. To lower the load, the lever is pulled slightly toward the operator; this action releases the brake slightly, but the clutch does not go in. It is impossible to leave the hoisting lever in anything but a braking position, as, immediately it is released, it automatically brakes the load by means of a counterpoise weight attached to the brake lever. Taking an average lift of five hundredweight to a height of six feet, lifting speed 85 feet per minute, and slewing speed of 250 feet per minute, through a distance of 25 feet, the time occupied in slinging, lifting the load, unhooking and returning is estimated at forty seconds.

"Lowke" Small Power Sets.

A number of special features are embodied in the small lighting and power plants made by Messrs. Lowke & Sons, Ltd., of Northampton. These are direct-coupled sets made in three standard sizes: .75, 1, and 3 kW, having, respectively,

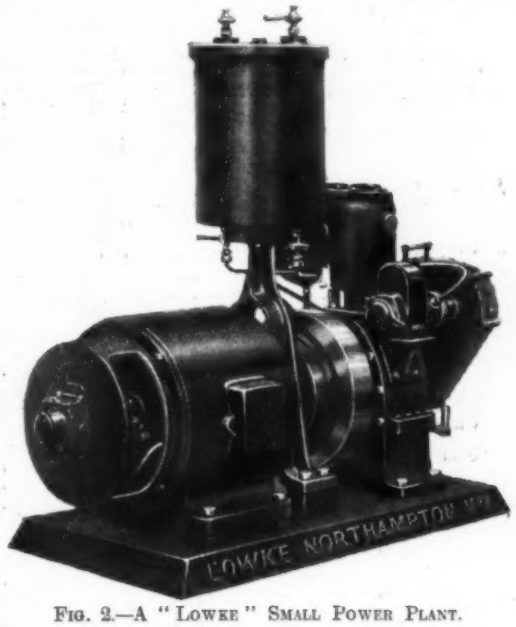

Fig. 2.—A "Lowke" Small Power Plant.

engines of 2, 3, and 8 b.h.p. The two smaller sizes are fitted with single-cylinder engines with petrol-paraffin carburettors. The fuel is supplied from a two-compartment tank, with control cocks, and the engine is thermo-syphon water cooled. The generator is shunt wound, with interpoles, giving 20 amps. at from 50 to 70 V. It is connected to the engine by a flexible coupling allowing the armature free end movement. A polished enamelled slate switchboard is supplied. This has upon it a voltmeter, ammeter, automatic cut-out, d.p. fuses for generator and outside circuits, a d.p. switch for generator, an s.p. switch for the lighting circuit, a voltmeter key, a self-starter, and a voltage regulator. The 8-kW generator is coupled to a 2-cylinder, 4-stroke engine running at 1,000 r.p.m. The generator is of the shunt wound interpole type, giving 30 amps. at 100/140 V. A very complete set of 30-amp. fuse and switchgear and instruments is provided.

Apart from these standard sizes, sets can also be supplied with capacities of 2, 4, 5, and 6 kW.

Fig. 2 illustrates one of the smaller sets made by the firm.

Fig. 1.—The "Prescot" Pillar.

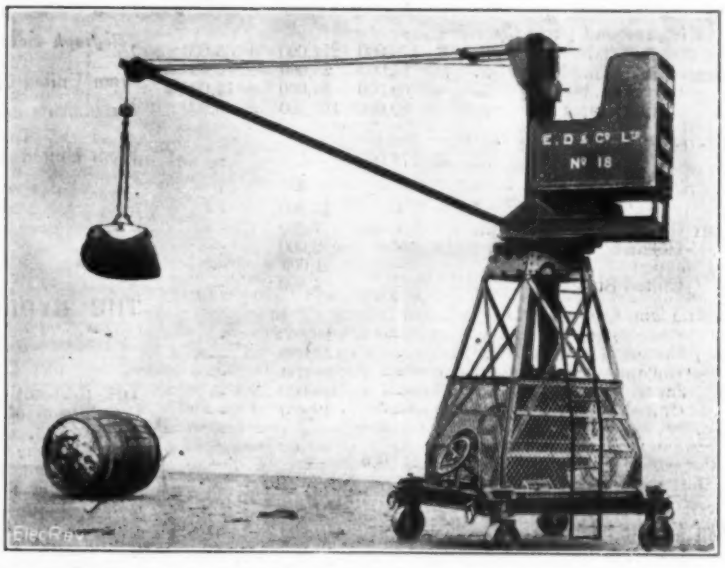

Fig. 3.—A Mobile Electric Dock Crane.

IMPORT TRADE OF INDIA.

The following statistics of the imports of electrical and similar goods into British India in the year ended March 31st, 1920, are taken from the recently-issued official trade returns, details for the year ended March 31st, 1919, being added for purposes of comparison, and notes of any increases and decreases given. Owing to the adoption of a more detailed classification in the official statistics, a comparison with former years is not possible in certain instances.

		1918-19	1919-20	Inc. or dec.
Copper wire, excluding telegraph and telephone wire.—				
Total ...	cwt.	11,238	6,861	– 4,577
	£	88,000	58,000	– 30,000
From United Kingdom	cwt.	502	3,460	+ 2,958
	£	4,000	26,000	+ 22,000
,, Japan	cwt.	8,200	1,880	– 6,320
	£	68,000	18,000	– 50,000
Iron wire other than fencing (a)—				
Total ...	tons	—	3,400	—
	£	—	170,000	—
From United Kingdom	tons	—	2,340	—
	£	—	90,000	—
,, Japan	tons	—	94	—
	£	—	7,680	—
,, United States ...	tons	—	3,280	—
	£	—	160,800	—
Electric generators—				
Total	£	15,000	252,000	+237,000
From United Kingdom ...	£	600	189,000	+188,400
,, United States	£	14,000	60,000	+ 46,000
Electric motors—				
Total	£	77,000	344,000	+267,000
From United Kingdom ...	£	25,000	126,000	+101,000
,, United States	£	50,000	215,000	+165,000
Other electrical machinery—				
Total	£	168,000	619,000	+451,000
From United Kingdom ...	£	108,000	244,000	+136,000
,, United States	£	43,000	356,000	+313,000
,, Italy	£	12,000	4,000	– 8,000
,, Switzerland	£	1,000	11,000	+ 10,000
Mining machinery—				
Total	£	73,000	156,000	+ 83,000
From United Kingdom ...		9,000	47,000	+ 38,000
,, United States		61,000	108,000	+ 47,000
Electric fans and parts thereof—				
Total	£	179,000	214,000	+ 35,000
From United Kingdom ...		15,000	25,000	+ 10,000
,, Italy		68,000	54,000	– 14,000
,, United States		89,000	135,000	+ 46,000
Electric lamps and parts thereof—				
Total	£	173,000	—	—
Electric glow lamps (a)—			£	
Total		—	15,000	—
From United Kingdom ...		—	7,500	—
,, Holland		—	2,000	—
,, Japan		—	1,000	—
,, United States		—	4,000	—
Electric lamps, other sorts (a)—				
Total		—	90,000	—
From United Kingdom ...		—	42,000	—
,, Holland		—	18,000	—
,, Japan		—	10,000	—
,, United States ...		—	19,000	—
Electrical wires and cables—				
Total	£	242,000	—	—
Electrical wires and cables (rubber insulated) (a)—				
Total		—	264,000	—
From United Kingdom ...		—	207,000	—
,, Japan		—	21,000	—
,, United States		—	34,000	—
Ditto (insulations other than rubber) (a)—				
Total		—	139,000	—
From United Kingdom ...		—	122,000	—
,, United States		—	12,000	—
Bare copper wire (electrolytic) (a)—				
Total		—	45,000	—
From United Kingdom ...		—	18,000	—
,, United States		—	9,000	—
,, Japan		—	19,000	—
Telegraph and telephone apparatus (a)—				
Total		—	63,000	—
From United Kingdom ...		—	24,000	—
,, Sweden		—	10,000	—
,, Japan		—	2,000	—
,, United States		—	27,000	—

	1918-19	1919-20	Inc. or dec.
	£	£	£
Electricity meters (a)—			
Total	—	34,000	...
From United Kingdom ...	—	25,000	...
,, Switzerland	—	8,000	...
Batteries (a)—			
Total	—	31,000	—
From United Kingdom ...	—	6,000	—
,, United States	—	25,000	—
Switchgear (a)—			
Total	—	61,000	—
From United Kingdom ...	—	32,000	—
,, Japan	—	2,000	—
,, United States	—	27,000	—
Transformers (a)—			
Total	—	26,000	—
From United Kingdom ...	—	4,000	—
,, United States	—	22,000	—
Interior electrical fittings (a)—			
Total	—	21,000	—
From United Kingdom ...	—	13,000	—
,, United States	—	7,000	—
,, Japan	—	1,000	—
Electrical instruments, &c., unenumerated.			
Total	361,000	571,000	+210,000
From United Kingdom ...	158,000	279,000	+121,000
,, Japan	62,000	19,000	– 43,000
,, United States	113,000	264,000	+151,000
,, Holland	17,000	2,000	– 15,000
,, Italy	—	3,000	—
Telegraphs, materials for construction and accessories.—			
Total	4,000	3,000	– 1,000
From United Kingdom ...	3,000	2,000	– 1,000
Telephones, materials for construction and accessories—			
Total ... ... £	17,000	19,000	+ 2,000
From United Kingdom ...	3,000	12,000	+ 9,000
,, Sweden	6,000	4,000	– 2,000
,, United States	6,000	2,000	– 4,000

In addition to the foregoing, the following were imported as Government stores :—

Machinery and millwork—			
Total ... ... £	255,000	447,000	+192,000
From United Kingdom ... £	244,000	404,000	+160,000
Telegraph material—			
Total	142,000	579,000	+437,000
From United Kingdom ...	141,000	578,000	+437,000
Instruments and apparatus—			
Total	306,000	419,000	+113,000
From United Kingdom ...	305,000	416,000	+111,000

(a) Not separately recorded prior to 1920.

THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO.

The thirteenth annual report of the Hydro-Electric Power Commission of Ontario, deals with what the chairman, Sir Adam Beck, describes as the most successful year in the history of the Commission.

Throughout the year ended October 31st, 1920, the country was passing through a period of re-adjustment following a sudden slump at the close of the war. Conditions have not yet become normal, and many industries are still awaiting a fall in costs before going back to ordinary production. This depression affected principally the Eugenia and Severn systems with a consequent serious reduction in revenue from these sources. The largest section—the Niagara system—also experienced a depression, but this was counter-balanced by increased business in other directions, and towards the end of the year the demand for power exceeded the supply. This was due in part to the expiration of a contract for a bulk supply from the Ontario Power Co., of Niagara Falls. It was found necessary during the year to increase the charges to a number of municipalities on this system, but in spite of this, increased business allowed practically every municipality to make a surplus. The cost of materials fell slightly towards the end of the year, and although labour costs remained high, the general efficiency improved. About the middle of the year arrangements were made for a supply of 9,000 h.p. by the Canadian-Niagara Power Co., and a further block of power is being negotiated for. This supply proved of great assistance, but restrictions had to be enforced when the power and light-

ing peaks became coincident. The Queenston-Chippawa development was somewhat retarded by labour troubles. In the first place the demand for unskilled labour could not be met. Owing to a strike the work was suspended for a month; this resulted in a loss of over $600,000 in non-productive overhead charges, &c., and in the purchase of extra equipment to compensate, as far as possible, for the time lost in the progress of the work. During the year, the Commission contracted for three complete additional generating sets, so that the initial installation will now be five sets instead of the original two. By means of electrically-operated shovels earth and rock was excavated and removed at the rate of half-a-million cubic yards per month, and at the then existing rate of progress all the excavation work in the canal proper should have been completed by June last. It was hoped that the first two generating sets, with an output of 100,000 h.p., would be in operation in September this year. All that remained to be done at the end of the year under review, was to install the second turbine and the two generators. Most of the switchgear and transformers have now been delivered. The switchgear includes a number of 15,000 and 155,000-V oil circuit breakers manufactured by the Canadian General Electric Co., and the Canadian Westinghouse Co. The latter firm is also supplying 15 15,000 kVA, 12,000/63,500-V, single-phase, water cooled transformers, and two 2,200 kVA, 500 r.p.m., 25 cycles, 2,300-V, generators to furnish power to auxiliaries, such as cranes, elevators, pumps, reserve motor-driven exciters, lighting, &c. Among the auxiliary equipment are two 150-ton electrically-operated cranes with equaliser lifting beam, supplied by the Dominion Bridge Co. of Montreal. These cranes are designed to work either independently or together. The equaliser lifting beam is for use when lifting the 300-ton rotors of the main generators.

The Nipigon development was proceeded with rapidly during the year. The tail race which is about 1,000 ft. long necessitated the excavation of 122,000 cu. yd. of earth, and 57,000 cu. yd. of rock. The forebay excavation entailed the removal of about 20,000 cu. yd. of material, chiefly rock. In order that the first part of the plant might be put into immediate operation the steel for the superstructure of the power-houses was erected and temporarily sheeted in. This enabled the turbine and generator erection to be rushed to completion, and the No. 2 unit was placed in commercial operation on December 20th, 1920, which was the scheduled date for the delivery of power to Port Arthur. The present installation consists of two 12,500-h.p., vertical single runner turbines, operating at 120 r.p.m. under a head of 72 ft. These are coupled to 60-cycle Canadian-Westinghouse generators.

It was expected to have in operation the Niagara development—the largest of all hydro-electric schemes—by the end of the present year. The power-house excavation for the first two main units was completed during 1920. These two units will be placed in commission and the other three units of the scheme will then be proceeded with.

With regard to surveys prior to the extension of supply in rural districts, owing to the high cost of construction, power shortage, and labour conditions, these were confined exclusively to those districts from which petitions were received. The Power Commission Act was amended so as to provide that, in the supply of electricity to rural districts, systems should not necessarily be confined to the geographic township boundaries, but could be arranged to provide for the most economic distribution of power from the nearest centre.

Final surveys were completed during the year for the construction of 122 miles of new electric railway, apart from the acquisition of existing lines.

The year reported upon witnessed an enormous increase in the activities of the Electrical Inspection Department; this was chiefly due to the extensive building operations carried out all over the Province and to the ever increasing demand for all kinds of domestic electrical apparatus. During the year the Department received 87,399 applications for new wiring and 160,990 inspections were made. Apart from new installations the Department was successful in having a large number of old installations overhauled and improved. A considerable amount of revenue was derived from the annual inspection system, which is growing in favour with the owners of factories and other industrial establishments.

A considerable increase in the volume of tests and investigations by the Laboratories Department took place during the year. Among the new equipment constructed was a corona voltmeter, capable of registering pressures up to 300,000 V. Included in the special tests carried out in the High-Tension Laboratory were tests upon cutouts for distribution transformers; the analysis and compilation of test and theoretical data on the subject of interference between power lines and communication circuits; current-carrying capacity of transmission lines under various atmospheric conditions, &c. In the other sections there was little change in the character of the work, but in every case there was a marked increase.

The accounts of the several systems show very satisfactory financial results. In the largest system (Niagara) the revenue amounted to $3,751,066; against this were placed the following items:—Power purchased, $1,966,304; operation costs, $585,099; interest, $644,859; renewals, $310,519; provision for contingencies, $48,715; sinking fund, $195,570; total, $3,751,066.

MEXICO AFTER REVOLUTION.

AFTER all the misfortunes and upheavals that have occurred in Mexico during the past decade, it is encouraging to learn that the country is certainly a potential market for goods of British manufacture. Such is the opinion expressed in the report by H.M. Consul-General at Mexico City, which has recently been issued by the Department of Overseas Trade.* He adds an important proviso, viz., that price and delivery are satisfactory to the importer. Subject thereto, it may be taken for granted that any of the manufactured goods which were imported into Mexico before the war can still be consumed by that market.

Among the articles for which there appears to be a demand may be mentioned agricultural machinery and implements, mining requirements, such as belting, wire cables, ore cars, rails, &c., oil engines, tin plate, corrugated iron and roofing materials.

Mexico City, Tampico, and Vera Cruz and a few other towns have good systems of electric tramways. The company operating in the capital, which obtains its power from the plant at Necaxa supplying the electric light, maintains an excellent service of express cars connecting the town with the suburbs.

Owing to the shortage of the rainfall in 1920, a serious diminution in the producing power of the Mexican Light and Power Co. is foreseen. To ameliorate the situation, it will be remembered that the Government issued a "Daylight Saving" Order, advancing the official time in the city by one hour. The Consul-General says that of this Order a considerable part of the community take no notice—an indifference which caused much confusion.

The railways suffered terrible damage during the revolutionary disturbances, the losses in rolling stock and locomotives being tremendous. Travelling and transport is consequently very difficult, and the congestion of goods at Vera Cruz and Tampico has been very great.

There are great possibilities of development in Mexico, given peace. Apart from the oil industry, it possesses great stores of mineral wealth which have so far been unexploited. Considerable activity was manifested during the year by several of the large gold and silver mining companies in securing new properties to replace those which showed signs of approaching exhaustion.

Coal has been mined in Mexico for over 20 years. There are deposits of lignite coal near the border at Laredo, and other known coal-fields are in Oaxaca and Guerrero. But the most important deposits are in the coal-fields at Sabinas (where there are 700 bee-hive coke ovens and three retort coke oven plants, the latter having a capacity of about 10,000 tons of coke per month) and Coahuila, which are estimated to be about 400 square miles in extent.

After alluding to the advantageous position held by United States firms with regard to the Mexican market, the report comments on the extreme importance of the personal element in dealing with purchasers. Without good agents, it is impossible to succeed in Mexico. The course recommended is for the British house to send out a commercial traveller, with samples, to examine the market and appoint his own agent. In the case of machinery, a man with expert knowledge is practically indispensable. In this respect it is said that the British are outdistanced by their American and German competitors.

Petrol-Electric Transmission.—The *Commercial Motor* recently published an article dealing with the merits and demerits of the petrol-electric system of power transmission for vehicles. The writer says that lorry drivers and others have come to regard the gearbox as a necessary evil, and it has become a tradition, while vested interests are loath to substitute a better means of driving. A petrol-electric vehicle is subject to none of the violent jars inseparable from the best of gears, speed variation being effected in a very smooth manner. The absence of mechanical connection between engine and axle isolates the former from the shocks encountered by the engine of the gear-driven vehicle. As regards overall efficiency, the petrol-electric system compares very favourably with other systems despite the intervention of a dynamo between the engine and the driving motor. One point of the system, however, requires attention. The hand-regulation of the dynamo field does not get rid of the aural attention necessary with other drives; automatic regulation would make the system nearly ideal.

A Swedish Turbo-locomotive.—Sweden inaugurated the turbo-locomotive on her railways on October 29th with an express train run from Stockholm to Upsala and back, a distance of 80 miles, in less than 2½ hours; at times the speed reached 55 m.p.h., the highest allowed in Sweden, says the *Daily Mail*. After passing through the turbine, the exhaust steam is led to an air-cooled condenser, the hot water from which is fed into the boiler. The trials show, it is claimed, that the turbo-locomotive consumes only half the quantity of fuel that is needed for an ordinary locomotive of the same horse power, and the new engine is much less noisy.

* H.M. Stationery Office, 1s.

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

28,170. "Mechanical sales apparatus." T. G. Anderson. October 24th.
28,175. "Coin-actuated electric apparatus for selling tickets, &c." T. G. Anderson. October 24th.
28,180. "Electric oven light." W. Hitchmough and P. H. Shade. October 24th.
28,192. "Thermionic valves." H. St. J. de A. Donisthorpe. October 24th.
28,194. "Electric furnaces" Norske Aktieselskab for elektrokemisk Industri Norsk Industri-Hypotekbank. October 24th. (Norway, November 1st, 1920.)
28,196. "Telephone exchange system." Western Electric Co., Ltd. October 24th. (United States, October 25th, 1920.)
28,210. "Radio transmitting systems." British Thomson-Houston Co., Ltd. (General Electric Co.). October 24th.
28,221. "Eliminating currents for wireless telegraphy." Radio Communication Co., Ltd., and J. Scott-Taggart. October 24th.
28,225. "Electric regulating systems." J. Etchells and Vickers, Ltd. October 24th.
28,232. "Electro-therapeutic apparatus." T. W. Fleeson and C. M. Sanche. October 24th. (United States, December 17th, 1920.
28,241. "Apparatus for precipitating dust from gases by electricity." Siemens-Schuckertwerke. October 24th. (Germany, October 22nd, 1920.)
28,242. "Single-layer winding for alternating current dynamos." Akt.-Ges. Brown, Boveri et Cie. October 24th. (Switzerland, October 28th, 1920.)
28,243. "Apparatus for suppression of higher harmonic voltages in alternating current dynamos." Akt.-Ges. Brown, Boveri et Cie. October 24th. (Switzerland, October 28th, 1920.)
28,249. "Electrical transmissions for direction purposes." Evershed & Vignoles, Ltd., and J. C. Needham. October 25th.
28,261. "Motor car commutators." P. Brindle. October 25th.
28,264. "Magneto electric machines." R. Bosch Akt.-Ges. October 25th. (Germany, November 8th, 1920.)
28,315. "Protective devices for electric circuits." W. E. Goodwin and Siemens Bros. & Co., Ltd. October 25th.
28,322. "Automatic circuit interrupter for ignition systems." E. B. Boughton. October 25th.
28,341. "System for detection of smoke or particles in suspension in a gas, &c." W. Kidde & Co., Inc October 25th.
28,352. "Portable apparatus for producing electric light or igniting a wick." H. H. Wolfe. October 25th.
28,354. "Appliance for inserting switch or control, &c., for apparatus within electric circuits." D. P. J. Kelly. October 25th.
28,385. "Electric lamps." E. J. L. Brook. October 26th.
28,389. "Electric light fixtures." T. S. Turnbull. October 26th.
28,393. "Electric switches." W. Preston. October 26th.
28,411. "Combination electric switch and fuse." A. H. Short. October 26th.
28,423. "Electric bed warmer." F. G. Beale. October 26th.
28,428. "Electric motor for gramophones." H. Henney. October 26th.
28,452. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). October 26th.
28,456. "Electric resistances." H. W. F. Ireland, H. Lucas, and W. C. Turner. October 26th.
28,460. "Electric, &c., locomotives, trams, road vehicles, ships, &c." W. P. Durtnall. October 26th.
28,461. "Electro-magnetic switching devices." J. Etchells and Vickers, Ltd. October 26th.
28,462. "Spark plugs." P. V. Carpenter. October 26th.
28,550. "Electrical fittings." W. M. Barrington, W. E. Bottom, and M. H. Goldfarb. October 27th.
28,561. "Electric dry battery." F. A. van Hooydank. October 27th.
28,568. "Impulsive driving mechanism for ignition magnetos." M. L. Magneto Syndicate, Ltd., and E. A. Watson. October 27th.
28,593. "Electrical transmitter microphones." B. A. Pilkington and E. D. Young. October 28th.
28,612. "Sparking plugs." W. Pickard. October 28th.
28,619. "Electrically driven reciprocating tool." J. Mackintosh. October 28th.
28,643. "Means for indicating and controlling charging of batteries." Rootes, Ltd., and J. G. Wilson. October 28th.
28,645. "Electrical connections in disconnecting link box." Macintosh Cable Co., Ltd., and D. D. Watson. October 28th.
28,659. "Wireless apparatus." B. H. N. H. Hamilton. October 28th.
28,660. "Electric motor." E. M. Green, H. Kerr Nisbett, and A. King. October 28th.
28,667. "X-ray apparatus." M. A. Codd and X Rays, Ltd. October 28th.
28,672. "Lamps operating by electric discharge." M. D. Scott. October 28th.
28,674. "Electric current wire insulators attached to poles, &c." G. H. Hosie. October 28th.
28,675. "Electrolytic starters or controllers for electric motors." Metropolitan-Vickers Electrical Co., Ltd., and A. E. L. Scanes. October 28th.
28,688. "Bonding devices for electrical junction boxes." Callender's Cable and Construction Co., Ltd. October 28th.
28,689. "Electric heaters." V. Gillgan. October 28th.
28,696. "Arc generators of electric oscillations." H. M. Dowsett. October 28th.
20,721. "Method of assembling and protecting electric wires for connecting commutator and ignition coils of internal combustion engines, &c." H. G. Southard and V. M. Meager. October 29th.
28,760. "Electric number indicator." F. W. Tennant. October 29th.
28,774. "Heat conserving apparatus in steam power plants." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electrical Manufacturing Co.). October 29th.
28,778. "Electric water heaters." A. S. Dorsey. October 29th.
28,779. "Electric water heaters." A. S. Dorsey. October 29th.
28,781. "Electric water heaters." A. S. Dorsey. October 29th.
28,790. "Apparatus for production of high-frequency oscillations by alternating current of low frequency." H. Sefton-Jones (Lorenz Akt.-Ges.). October 29th.
28,791. "Process for increasing frequency by static frequency transformer, &c." H. Sefton-Jones (C. Lorenz Akt.-Ges.). October 29th.
28,815. "Mouthpieces for telephones, speaking-tubes, &c." T. D Powell. October 31st
28,820. "Railway signalling apparatus." Automatic Telephone Manufacturing Co., Ltd., and A. E. Hudd. October 31st.
28,827. "Electric lamps." J. F. Lymburn and J. Wakefield & Sons, Ltd. October 31st.
28,831. "Combined ammeters and voltmeters." W. B. Morris. October 31st.
28,832. "Voltmeters, ammeters, &c." W. B. Morris. October 31st.
28,840. "Shock-absorbing device for electric lamps." W. E. Preston. October 31st.
28,846. "Signalling system for protecting safes, &c." W. I. Becaouri. October 31st.
28,848. "Dynamo-electric machines." G. Somajni. October 31st. (Italy, October 30th, 1920.)
28,853. "Electric alarms." A. Huther and H. Weske. October 31st.
28,871. "Thermionic valve for wireless telegraphy, &c." W. R. Bullimore. October 31st.
28,880. "Electric time switches." A. Hortsmann, E. H. Hortsmann, and Hortsmann Gear Co., Ltd. October 31st.
28,884. "Respirator mouthpieces and telephone transmitters." J. Kelly. October 31st.
28,888. "Electrical transmission of communications." National Pneumatic Co. October 31st. (United States, May 16th.)
28,889. "Radio-signalling systems." National Pneumatic Co. October 31st. (United States, May 16th.)
28,895. "Electric condensers." British Thomson-Houston Co., Ltd. (General Electric Co.) October 31st.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

15,717. "Construction of vacuum tubes and the like as used for radio-signalling." J. Scott-Taggart and Radio Communication Co., Ltd. June 10th, 1920. (170,327.)
16,106. "Suspension of electric traction wires." Metallurgique Electrique." February 19th, 1914. (140,042.)
16,369. "Bow current-collectors in overhead wire systems of electric traction." Brecknell, Munro & Rogers, Ltd., and A. M. Willis. June 17th, 1920. (170,331.)
16,415. "Generation of electrical oscillations." British Thomson-Houston Co., Ltd. July 8th, 1919. (146,946.)
16,432. "Arc lamps, more especially for searchlights." Siemens Schuckertwerke Ges. August 20th, 1917. (145,422.)
19,342. "Coarse and fine adjustment suitable for tuning and coupling devices for wireless telegraph apparatus." Ges. fur Drahtlose Telegraphie. November 10th, 1917. (147,439.)
19,584. "Electro motors." Frankfurter Maschinenbau-Akt. Ges. Vorm. Pokorny & Wittekind. March 18th, 1916. (147,627.)
19,690. "Production and control of high-frequency currents in static transformers with auxiliary magnetisation especially for use in wireless signalling." Ges. fur Drahtlose Telegraphie. February 26th, 1914. (147,702.)
19,759. "Telephone and like systems." M. Latour. May 23rd, 1919. (147,756.)
19,801. "Method of constructing armatures and stators for dynamo-electric machines." V. G. Apple. December 30th, 1916. (147,773.)
19,803. "Method of building commutators for dynamo-electric machines." V. G. Apple. January 22nd, 1917. (147,775.)
19,804. "Method of uniting armature terminals adapted for building commutators for dynamo-electric machines." V. G. Apple. January 22nd, 1917. (147,776.)
19,815. "Dynamo-electric machines." V. G. Apple. March 21st, 1918. (147,787.)
19,818. "Method of connecting conductor bars of dynamo-machines." V. G. Apple. May 20th, 1918. (147,790.)
13,845. "Electro-magnetic wave-receiving systems." Soc. Francaise Radio-Electrique. June 1st, 1915. (147,802.)
13,857. "Electric starting systems for internal-combustion engines." British Thomson-Houston Co., Ltd. January 16th, 1917. (147,812.)
13,864. "Electron discharge devices." British Thomson-Houston Co., Ltd. October 31st, 1917. (147,819.)
19,992. "Sound producing or receiving devices containing two or more vibratory structures." Signal Ges. February 29th, 1916. (147,937.)
19,995. "Sound transmitting and receiving apparatus." Signal Ges. (August 6th, 1917. (147,940.)
20,001. "Submarine sound receiver." Signal Ges. August 12th, 1918. (147,946.)
20,033. "Generation of high-frequency oscillations." British Thomson-Houston Co., Ltd. June 3rd, 1918. (148,131.)
20,357. "Sound producing or receiving devices containing two or more vibratory structures." Signal Gas. June 5th, 1917. (Addition to 147,937.) (148,412.)
20,359. "Sound producing or receiving devices containing two or more vibratory structures." Signal Ges. February 22nd, 1918.(Addition to 147,937.) (148,414.)
20,994. "Three-arm choking-coil or transformer with inductance variable by continuous or alternating current of low frequercy." Allgemeine Electricitats Ges. September 17th, 1914. (149,236.)
21,000. "Sparking plugs." J. Hanman. July 12th, 1920. (170,344.)
21,178. "Electric propulsion of ships." M. R. De Coninck. July 15th, 1919. (144,268.)
21,251. "Portable dynamo-electric lamp." G. Poole. July 14th, 1920. (170,357.)
21,507. "Dynamo-electric machines." J. Stone & Co., Ltd., and A. E. Honey. July 16th, 1920. (170,375.)
21,537. "Trigger relays especially for use in radio-communication." J. Scott-Taggart and Radio Communication Co., Ltd., and L. B. Turner. July 17th, 1920. (Addition to 130,408.) (170,377.)
21,538. "Modulation systems and the like in radio-communication and the like." J. Scott-Taggart and Radio Communication Co., Ltd. July 17th, 1920. (Cognate application 25,066/20.) (170,378.)
21,585. "Wireless telegraphy." S. O. E. T. Trost. July 18th, 1919. (151,253.)
21,609. "Relays and their application to automatic telephone or like systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.) July 19th, 1920. (170,385.)
21,735. "Telephones." G. B. Riley. July 20th, 1920. (Cognate application 4,737/21.) (170,400.)
21,755. "Electric switches." C. L. J. B. Nadaud and F. Young. July 20th, 1920. (170,401.)
21,766. "Contacts for electric fuses, cut-outs, and the like." A. Reyrolle & Co., Ltd., and W. A. Harriman. July 20th, 1920. (170,402.)
21,875. "Magneto-electric lamps." Philipps Akt. Ges. July 24th, 1919. (149,345.)
22,120. "Method of and apparatus for conveying electric current to a movable truck or the like." H. R. Lamb and H. Huartson. July 24th, 1920. (170,414.)
22,271. "Mercury signal arm contact." W. R. Sykes Interlocking Signal Co., Ltd., and F. J. Sykes. July 26th, 1920. (170,420.)
23,308. "Control devices for electric circuits." C L. I. Manufacturing Co., Ltd., and E. A. Watson. August 9th, 1920. (Cognate application 27,360/20.) (170,435.)
23,347. "Receiving methods of radio telegraphic and radio telephonic signals." C. Bardeloni. January 10th, 1918. (149,973.)
24,820. "Electrically-heated cooking-utensils." B C. Joseph and N. C. Joseph. August 27th, 1920. (Addition to 158,073.) (170,459.)
25,669. "Sparking plugs." A. G. Brown. September 6th, 1920. (Addition to 145,348.) (170,469.)
25,872. "Electric switching systems for charging batteries." J. Atkins. September 8th, 1920. (170,472.)
25,983. "Subaqueous sound-producing devices." Signal Ges. September 22nd, 1919. (151,603.)
26,792. "Dynamo-electric machine commutators and similar electrical apparatus." R. A. L. Volet. October 13th, 1919. (152,658.)
34,236. "Means for regulating the frequency of alternating currents." Soc. Francaise Radio Electrique. December 6th, 1919. (154,908.)

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10,394. "Control of alternating-current electric motors." Metropolitan-Vickers Electrical Co., Ltd. June 17th, 1920. (165,072.)
10,591. "Telephone exchange systems." A. H. Adams. May 12th, 1920. (163,288.)
19,255. "Apparatus for use in connection with metal vapour rectifiers." Siemens Schuckertwerke Ges. July 31st, 1920. (167,163.)
23,261. "Electron discharge amplifiers." British Thomson-Houston Co., Ltd. October 29th, 1913. (Divided application on 147,148.) (168,893.)